MODERN REFRIGERATION AND AIR CONTROL

Vol. 64 No. 759 PLASTICS JUNE, 1961 ISSUE Price 2s. 6d. monthly

completely packaged

TEMKON

auto-defrost refrigeration

for cold store applications

TEMPERATURE RANGE:
−5°F to 38°F (water cooled)
+15°F to 38°F (air cooled)
Completely automatic hot gas defrost
Entirely self contained with hermetically sealed refrigeration system
Easily installed in any cold room
More cold room space – unit only projects 10″ into store
Suitable for overall wall thickness of from 3″ to 12″
Only simple external wiring required
Air or water cooled plants
Moderate prices and economical operation

P6038

TEMPERATURE LIMITED

BURLINGTON ROAD FULHAM LONDON S.W.6 ENGLAND PHONE RENOWN 5813 (P.BX.) CABLES TEMTUR LONDON
MAKERS OF THE WORLD'S QUIETEST ROOM AIR CONDITIONER

STANDARD
UNIT COOLERS

LOW
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UNIT COOLERS

ELECTRIC
DEFROST

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Types :

CEILING
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(ceiling mounted)

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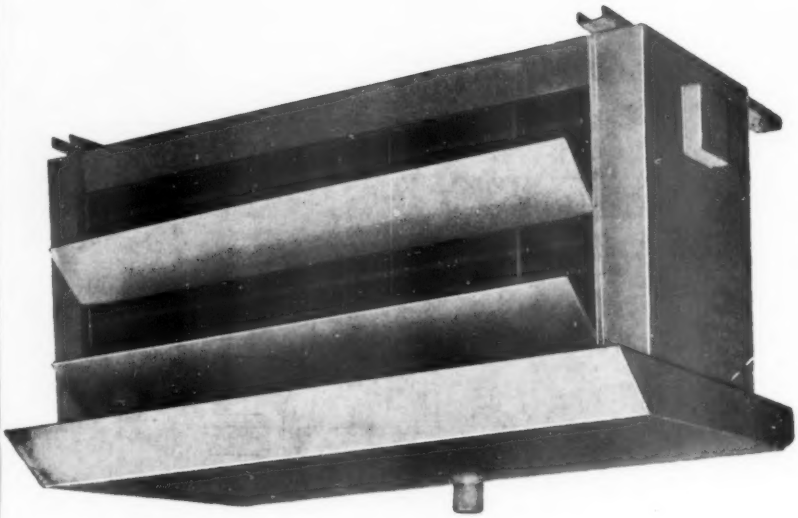
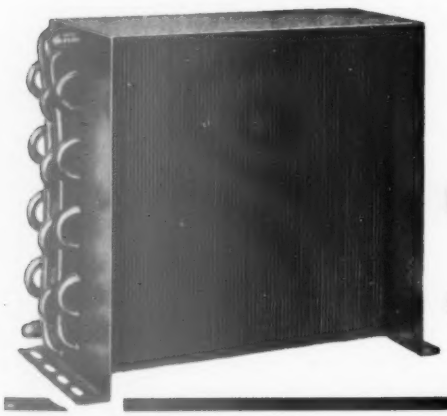
COOLERS
(ceiling mounted)

S.A.E.R.
UNIT COOLERS



CONDENSERS
FOR HERMETIC AND OPEN UNITS



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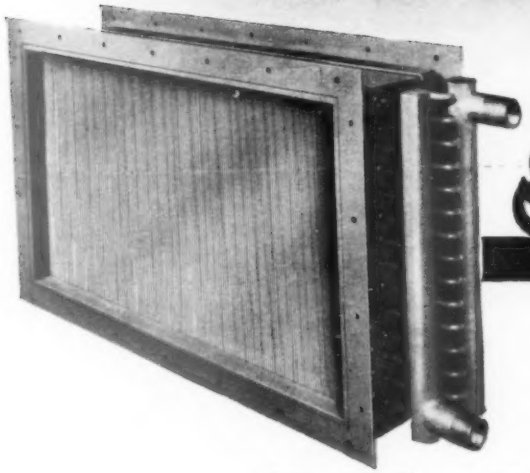

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For all systems, using steam or hot water

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A wide range of standard models, covering small and large air-flows

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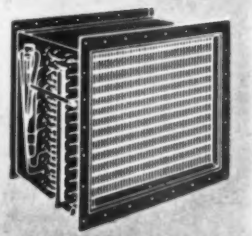
Brine, Chilled Water and Direct Expansion Refrigerants including coils for Solvent Recovery



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'Vortex' self-priming centrifugal pumps—providing the easiest and most economical method of small capacity pumping to high heads.

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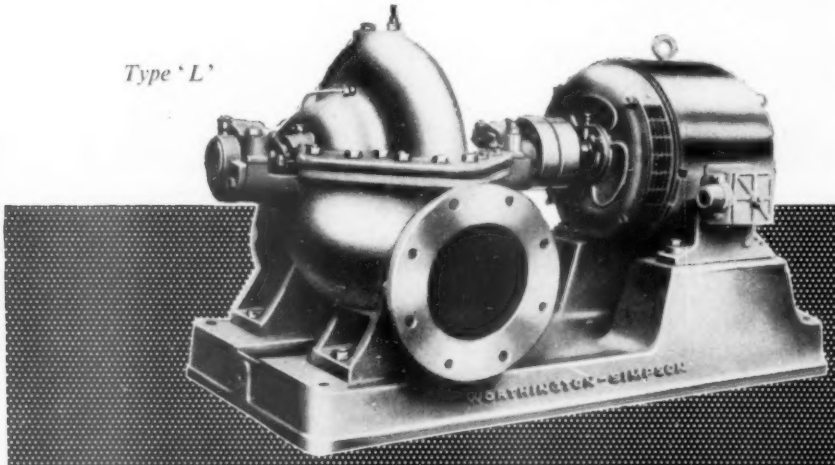
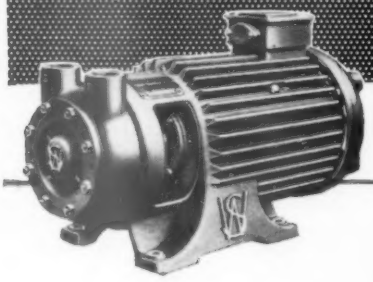
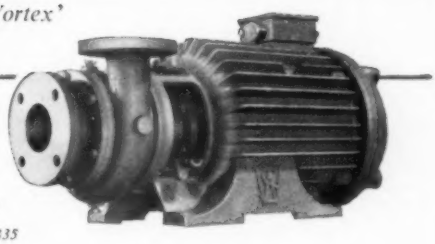




'Vortex'



'Monobloc'

Patent Number 591835

pumps for the refrigeration industry by

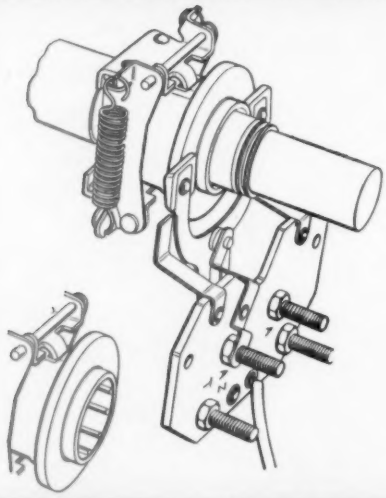
Worthington - Simpson Ltd

PUMPS • COMPRESSORS • HEAT EXCHANGE EQUIPMENT

NEWARK NOTTS

F.H.P. motors are not expensive machines yet they have to be extraordinarily robust and absolutely reliable — often with very little maintenance. Designing for this kind of reliability at a competitive price is far beyond the realms of text-book formulæ. The things that distinguish a really successful design are often details — but important ones — based on knowledge won the hard way; from years of making motors and servicing them in the conditions under which they run.

This thing called know-how



A detail of this kind is the centrifugal switch on our split-phase and capacitor-start motors. The problem with such switches is to derive a snap action on both opening and closing from an operating force that increases and decreases smoothly. In the switch shown here the restraining springs are so designed that their leverage decreases as the fly-weights open. Thus, increasing centrifugal force meets decreasing resistance and, at the set speed, wins outright; the collar snaps back smartly opening the contacts at the base of the yoke. On test, switches have snapped open and closed well over 1,000,000 times without failure — a level of reliability typical of the motors themselves.

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"OPINION"

VAPOURINGS

We are earnest when we remind you that 'water vapour will pass (and carry on passing in spite of all you can do) through every known substance, at a rate associated with the pressure drop and the relative mass and density of the barrier erected'.

Bite on this—it's the truth.

What would you use, a newspaper, or 10 in. of solid lead ?

Well, it's a problem and it has a practical answer. For goodness' sake let's have some practice to dilute the present mass of theory and idle speculation.

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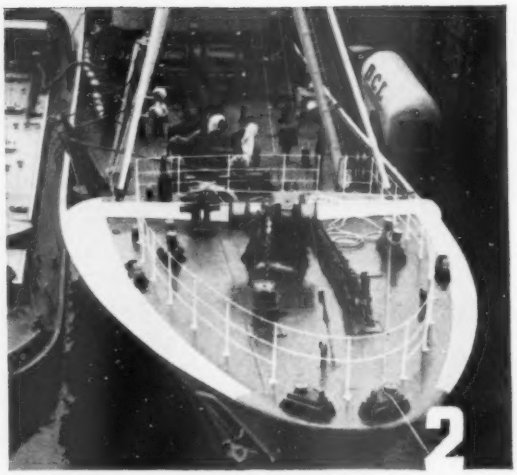
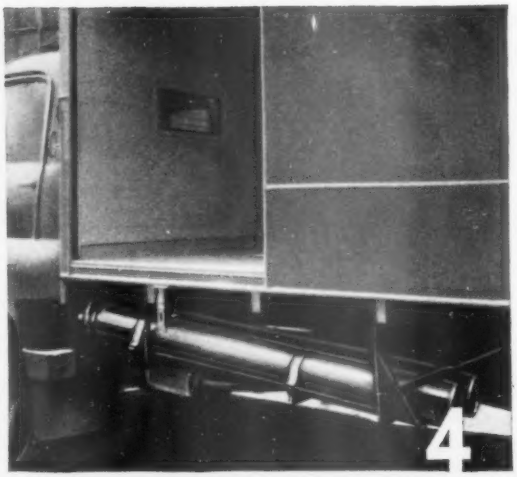


DisChiL FOOD PRESERVATION SERVICE **—gives immediate temperature drop**



When DisChiL is injected into an insulated container, with the doors closed after loading, the inside temperature drops to sub-zero—or any desired low temperature—in seconds. Now, there are four ways to obtain this service. The choice is yours.

1. Pull in at the nearest DisChiL depot
2. For a large requirement, arrange for a DisChiL road tanker to call, by appointment
3. Keep your own bulk supply of DisChiL on your premises
4. Have a DisChiL cylinder mounted on your van

If you will write to us, we will be glad to give you details of any or all of these methods.

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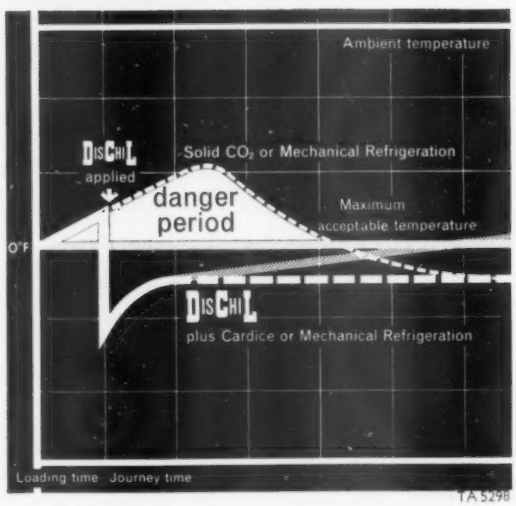

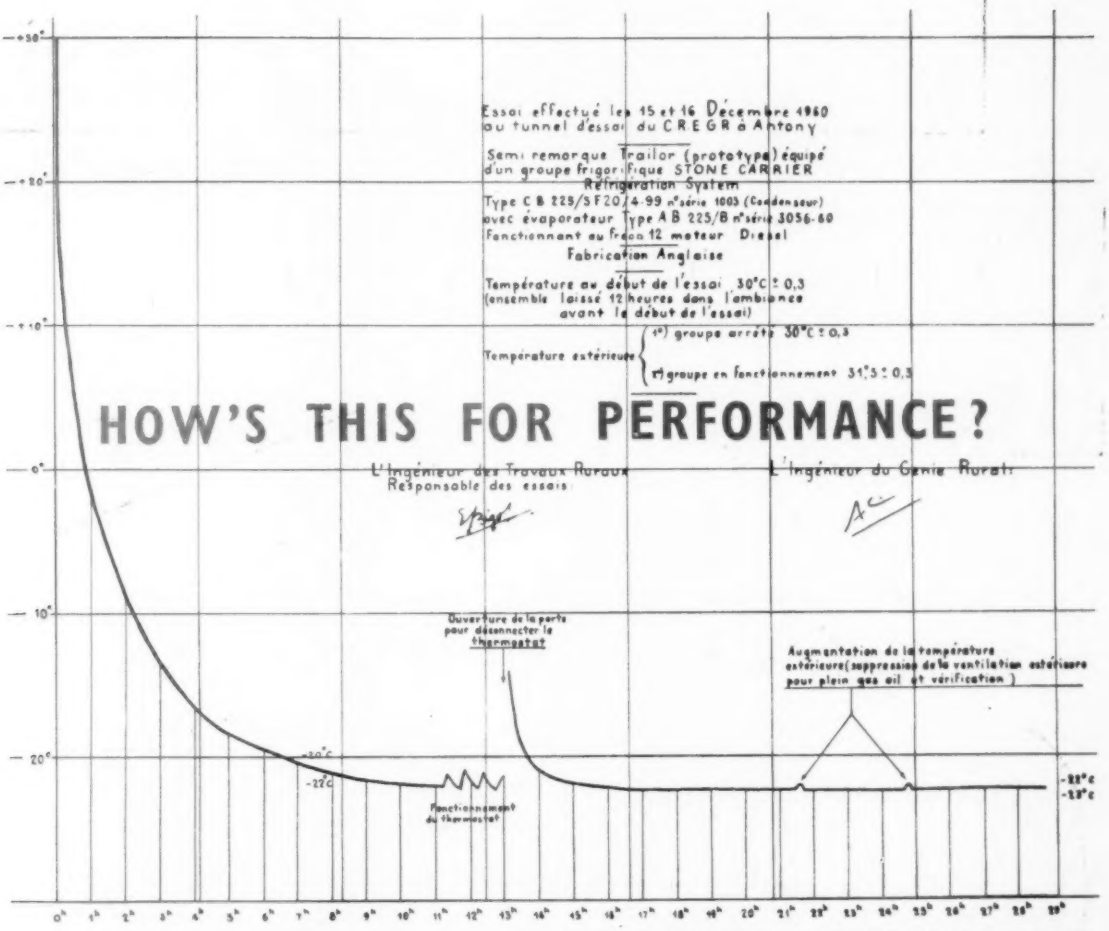
Essai effectué les 15 et 16 Décembre 1960
au tunnel d'essai du CREGR à Antony
Semi remorque Trailor (prototype) équipé
d'un groupe frigorifique STONE CARRIER
Refrigeration System
Type C B 225/SF20/4-99 n°série 1003 (Condenseur)
avec évaporateur Type A B 225/B n°série 3056-60
Fonctionnant au fréon 12 moteur Diesel
Fabrication Anglaise
Température au début de l'essai 30°C ± 0,3
(ensemble laissé 12 heures dans l'ambiance
avant le début de l'essai)
Température extérieure
1°) groupe arrêté 30°C ± 0,3
2°) groupe en fonctionnement 31°,5 ± 0,3
HOW'S THIS FOR PERFORMANCE?
L'Ingénieur des Travaux Ruraux
Responsable des essais
L'Ingénieur du Genie Rural
Ouverture de la porte
pour déconnecter le
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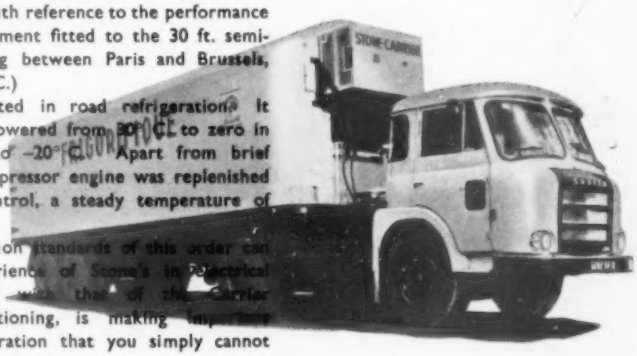
extérieure (suppression de la ventilation extérieure
pour plein gaz oil et vérification)
-20°c
-22°c
Fonctionnement
du thermostat
-22°c
-23°c

achieved by STONE-CARRIER TRUCK REFRIGERATION

Reproduced above is a test certificate issued by the Research and Experimental Centre of the French Ministry of Agriculture with reference to the performance of STONE-CARRIER truck refrigeration equipment fitted to the 30 ft. semi-trailer shown. (This vehicle is now running between Paris and Brussels, carrying ice-cream at a temperature of –34° C.)

This is worth studying if you are interested in road refrigeration. It indicates that the interior temperature was lowered from 30° C. to zero in 55 minutes and subsequently pulled down to –20° C. Apart from brief periods when the diesel supply for the compressor engine was replenished or alterations made to the thermostatic control, a steady temperature of –22° C. was held for nearly 24 hours.

With STONE-CARRIER equipment, refrigeration standards of this order can be at your disposal also. The vast experience of Stone's in practical installations on wheeled vehicles, coupled with that of the Carrier organisation in refrigeration and air-conditioning, is making important developments in the science of road refrigeration that you simply cannot afford to ignore.



Make sure its stone cold with Stone-Carrier

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COST saving

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Here is a new Tecumseh condensing unit which is available with the famous Tecumseh Pancake hermetic compressors. These compressors have the same compact dimensions with a variety of horsepower capacities and when used in conjunction with our new P81H and P6312H (with valves) condensing unit, provide a more compact and more economical unit which is particularly suitable for the smaller commercial cabinets and self-service display counters. The units are available with or without valves. Please write for further details.

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packaged liquid-cooling sets for the air conditioning system in the new BEA building at London Airport

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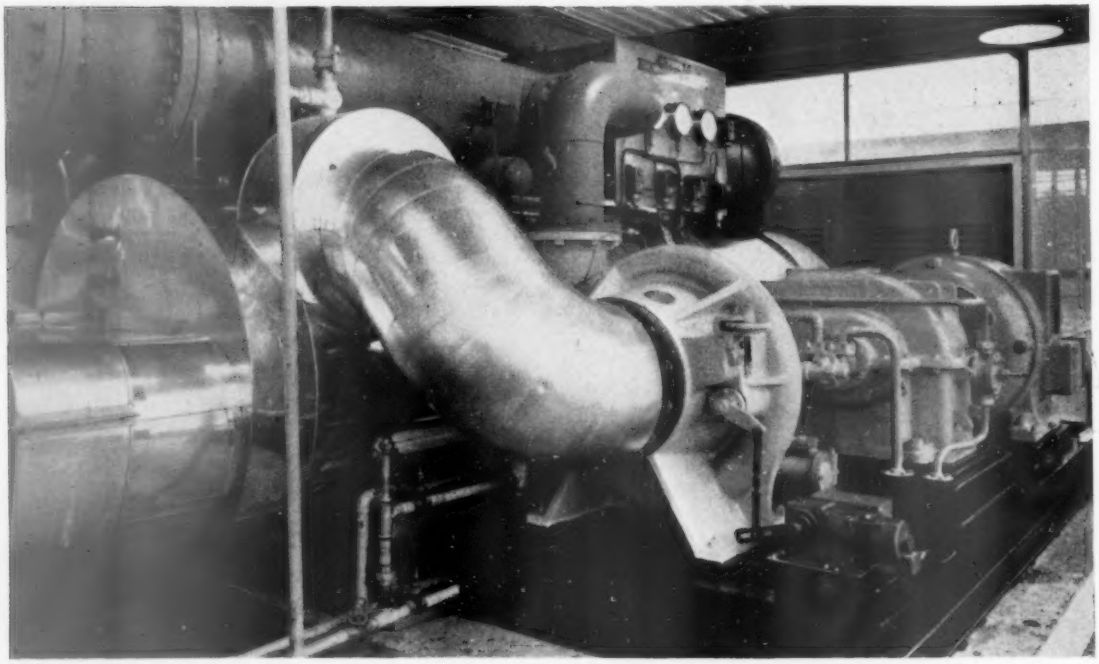
- *Compact—each set comprises a York 200 h.p. single stage turbo compressor and shell and tube heat exchangers.*
- *The compressor will operate down to about 10% of full load without hot gas by-pass and therefore provides economy in power consumption at reduced output.*



York Turbomaster liquid cooling sets, using Refrigerants R11 and R114 are available in a wide range of capacities. The Turbomaster compressors can also be offered for special applications using R12, R22, Propylene, Butane, Ammonia, etc.

For more details of these and other plants in the extensive York range write to :—

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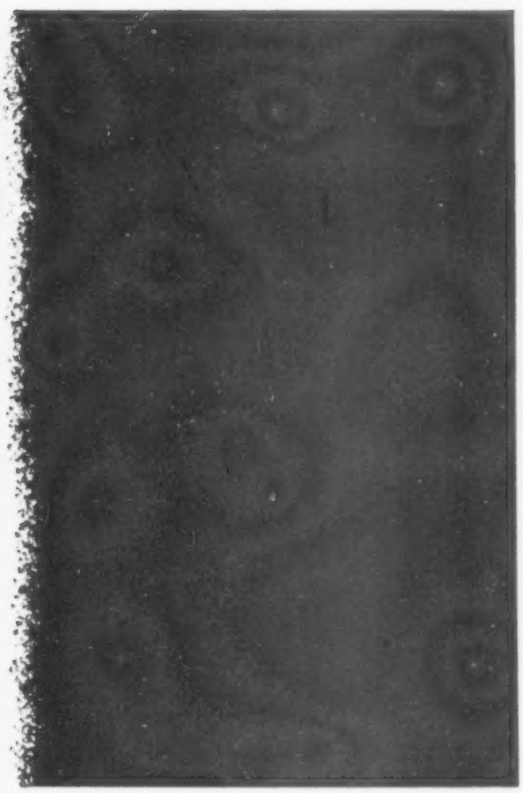

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I.C.I.'s new heat-transfer medium for industrial refrigeration

'THERMOCAL' DF—most anti-corrosive of all glycol based heat-transfer media now employed in industrial refrigeration—is widely used to prevent frost build-up on primary refrigeration coils; it can also be used as the main coolant.

'THERMOCAL' DF sets a new standard of corrosion-resistance—with a corresponding (and profitable) reduction in plant maintenance and stoppages.

Aqueous solutions of 'THERMOCAL' DF freeze well below 0°C. and can be used as defrosting fluids, industrial coolants and heat-transfer media between -40°C. and 100°C. These solutions have outstanding resistance to corrosion, high specific heats and thermal conductivities, long-term stability over a wide range of temperature, low coefficients of expansion and low flammability.

Think about 'THERMOCAL' DF—if you want to know more about it, please write. For a technical visit, please get in touch with your nearest I.C.I. Sales Office.

IMPERIAL CHEMICAL INDUSTRIES LTD.,
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H.87

set the seal on cold storage efficiency... with these BITUTHERM products

★ **BITUTHERM VAPOURSEAL** . . . a brush-applied emulsion that gives a resilient stable and durable film of low water vapour permeability on the " hot " side of insulation in cold storage construction.

★ **BITUTHERM TROWELSEAL** . . . a trowel-applied bitumen/latex emulsion also of low permeability to water vapour.

★ **BITUTHERM ADHESIVES** . . . for fixing insulating materials.

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★ **BITUTHERM COLD CAULKING COMPOUND** . . . a cold applied non-setting compound for expansion joints in coldstore floors, designed to retain its plasticity down to −20° F.

BITUTHERM aids to better refrigeration—another case of *applied plycology*

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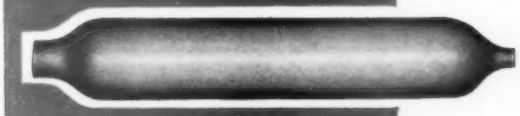
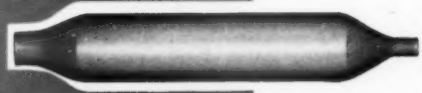
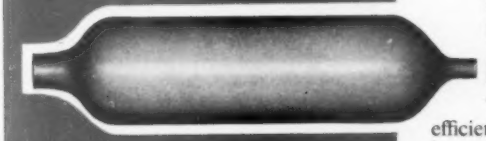
DAVID SCOTT *NEW* Molecular Sieve DRIERS

LOW INITIAL COST *PLUS* 9 times greater efficiency than Standard Driers

The Sieve Driers that Save







This is good news for all sealed refrigeration system manufacturers. David Scott high side molecular sieve driers are now nine times more efficient than standard driers. With a desiccant consisting of a molecular sieve filled with type 4A 8 x 12 mesh beads, they have actually nine times the normal adsorption. Consider the economic advantage. With David Scott high side driers you save size and weight.

FIRST CLASS CONSTRUCTION

Construction of these remarkable new driers is carried out in spun copper shell with a desiccant between two fine-mesh strainers. Outlets screen is of bag construction with secure retention in a brass ring pressing. This is formed from a 150 mesh twill weave wire cloth or equivalent in either phosphor bronze or monel.

PRE-PURCHASE PROTECTED

The greatest care is taken to ensure 100% efficiency. All driers are manufactured and stored in an air-conditioned atmosphere.

EASY AND SAFE TRANSPORTATION

Though there is the minimum risk of moisture adsorption from the surrounding atmosphere, David Scott new high side driers can be individually sealed before leaving the factory. All driers are shipped in hermetically sealed canisters.

Inlet and outlet connections conform to manufacturers own requirements.

Other David Scott products include RECHARGEABLE DRIERS from ¼" o/d to 1⅛" o/d pipe, and ACCUMULATOR DRIERS with copper shell squeezed and silver soldered at each end.

★ *A special feature of the David Scott service is the manufacture of driers to clients own specifications.*

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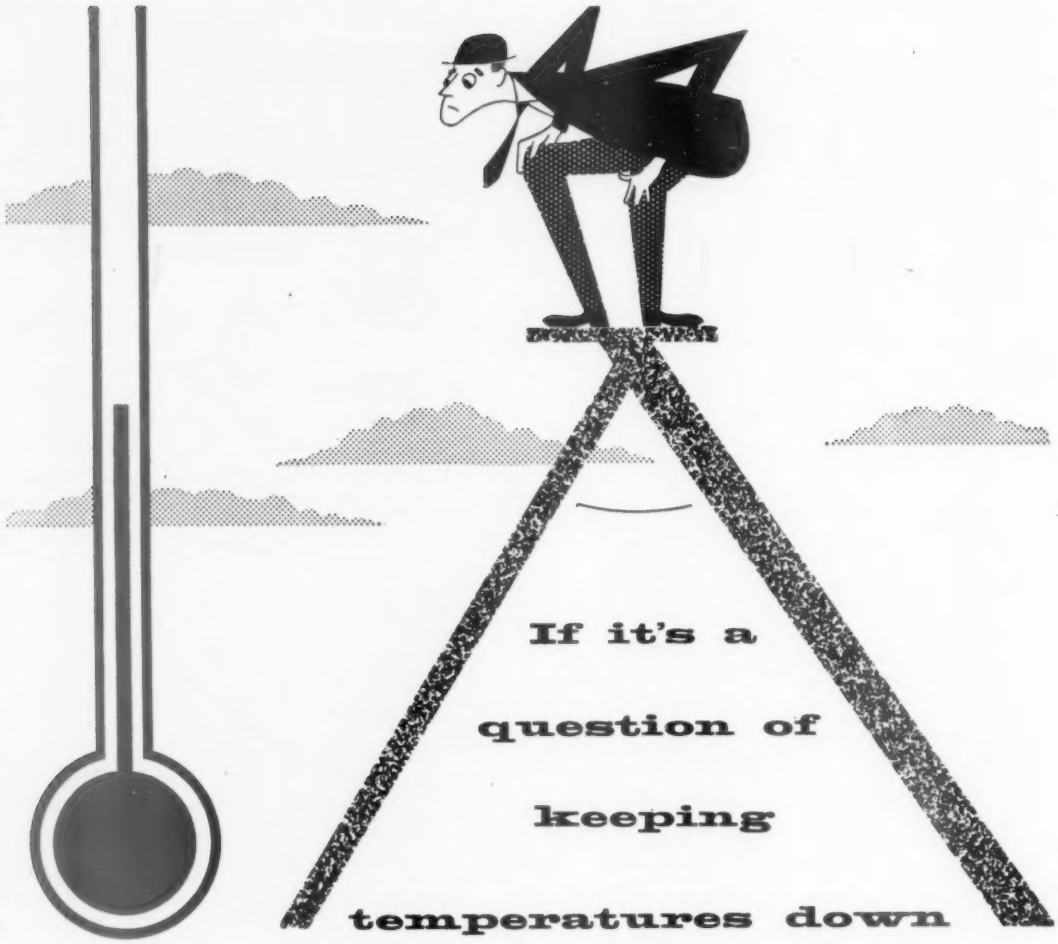
TELEPHONE HALFWAY 4621



Whenever low temperature insulation is concerned, Newalls are the people to look to. They have a background of over 50 years experience in all kinds of contracts—in cold stores, in cargo and passenger ships, in breweries and creameries — in fact wherever there are refrigerated spaces.

Newalls supply *and* apply low-temperature insulation materials and their service is available through each of eight depots situated throughout the United Kingdom. When the specification calls for a first class job, call in Newalls.

Newalls

LOW-TEMPERATURE INSULATION

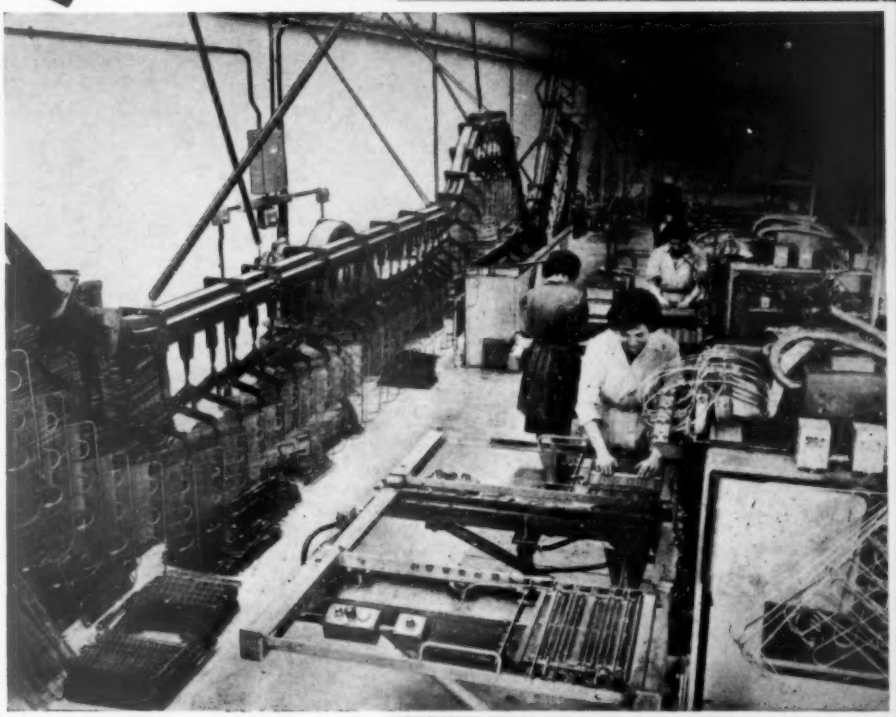
NEWALLS INSULATION CO. LTD. *Head Office :* WASHINGTON, CO. DURHAM.
A member of the TURNER & NEWALL ORGANISATION

Offices and Depots at LONDON, GLASGOW, MANCHESTER, NEWCASTLE UPON TYNE, BIRMINGHAM, BELFAST, DUBLIN, BRISTOL and CARDIFF. *Agents and Vendors in most markets abroad.*

45

EFFICIENT REFRIGERATION NEEDS SCOTT CONDENSERS

...and here is a section of
the most up-to-date plant
in Britain for the production of
REFRIGERATION CONDENSERS



Scott condensers are made in the most modern factory in the country with fully automatic multiple spot welding equipment capable of coping with condensers up to 20 rows and up to 128 wires with a maximum length of 2½ pitch.
Full information on request.

DAVID SCOTT
AND COMPANY LTD

KELVIN AVENUE, HILLINGTON, GLASGOW, S.W.2 TELEPHONE: HALFWAY 4021

J-A-A-K-O-N-E — REFRIGERATION

Automatic 183

AUTOMATIC DEFROSTING

CAPACITY
18.3 cu. ft. net

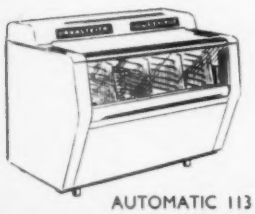
Price £390 . 0 . 0
(Plus D. & I. charge)

JAAKONE cabinets are of high grade rust-proofed steel, all welded joints and finished in baked high gloss enamel, white or ice blue. SPECIAL QUALITY FEATURES include: 5 ply glazing units, rubber tyred ball-bearing castors, clear-view night covers, full set of polythene coated wire baskets standard on all frozen food cabinets. Stainless steel trims on all cabinets. The refrigerating unit is the world famous STERNE TECUMSEH.

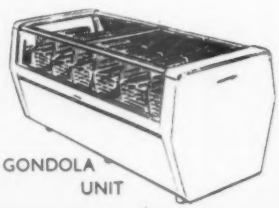
SOLE DISTRIBUTORS with suitable servicing facilities can be appointed for some areas.

DISPLAY COUNTER

WALL UNIT



AUTOMATIC 113



GONDOLA UNIT

J-A-A-K-O-N-E — LOOKS YEARS AHEAD OF IT'S TIME

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PALACE REFRIGERATION
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To PALACE REFRIGERATION (Swansea) LTD.

Please send me details of **JAAKONE REFRIGERATION**

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YORKSHIRE IMPERIAL METALS LIMITED

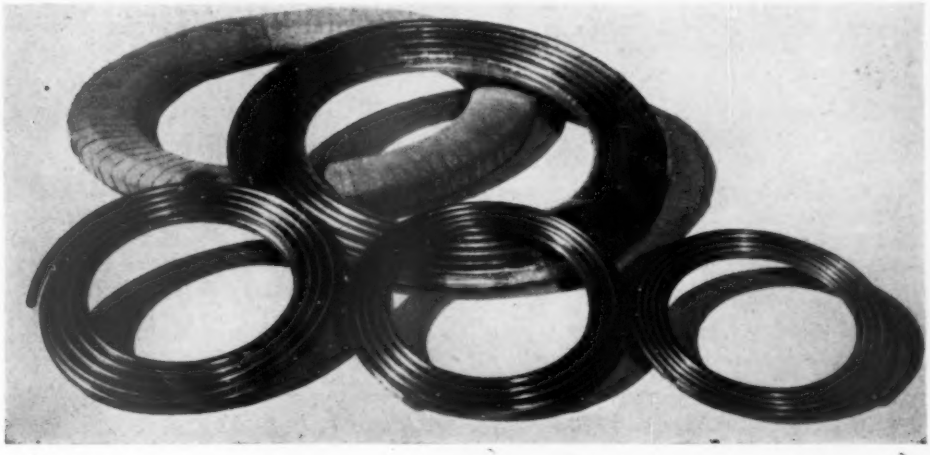
YORKSHIRE IMPERIAL

Refrigerator Tubes ensure a first-class product

When you order *Yorkshire Imperial* you are assured of high-quality refrigerator tubes with clean, smooth bores, dehydrated, and delivered in sealed coils of the correct temper. They are double-wrapped and will remain in first-class condition until you are ready to use them.

The tubing is coiled in double pancake coils in 20 ft., 50 ft. and 100 ft. lengths—or supplied in straight lengths—and when required can also be tinned on the outside.

Yorkshire Imperial also manufacture restrictor and bulb-and-capillary tubing—and a range of special "Yorkshire" Fittings for refrigeration work.



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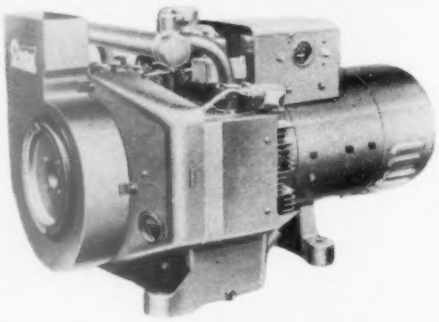
THE GENERATING SET *ENGINEERED* FOR REFRIGERATED VEHICLES

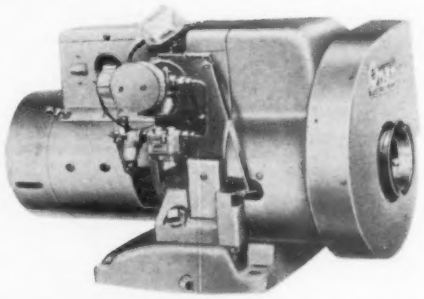
Onan Vacu-Flo cooled packaged Generating Sets provide ample power for the operation of electrically driven open and sealed type refrigeration units giving High Performance with long life, minimum operating and maintenance costs.

Vacu-flo Cooling System

Exclusive to Onan—overcomes cooling problems in confined space. Cooling air is drawn through and over the generator and engine and exhausted through an outside duct.



ONAN 5CCK Generator with Vacu-flo Cooling gives 5 k.w. of packaged power and will handle refrigeration units of up to 3 h.p. Model 305 CCK meets the requirements of units up to 2 h.p.
LOOK AT THE WEIGHTS—5 k.w. Model ONLY 375 lbs., 3½ k.w. Model ONLY 314 lbs.



ONAN Model 205AJ-2RV with Vacu-flo Cooling Ideal for mounting in sound-proofed compartment in Refrigerated truck or mobile shop for the operation of Refrigeration Compressors up to ¾ h.p. Frozen Food Display Cabinets or for providing power and light for mobile sales and display vehicles. Built for long life and quietness of operation. Full details on request.

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Our After Sales Service is unmatched by any other suppliers.

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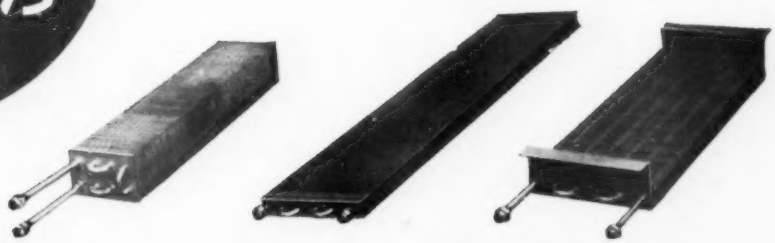
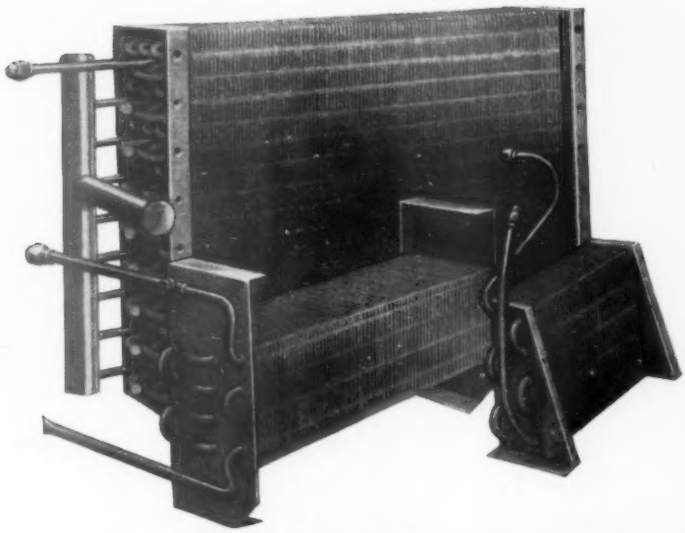
Manufacturers of Coolers and Condensers for Commercial, Industrial Refrigeration and Air-Conditioning Applications

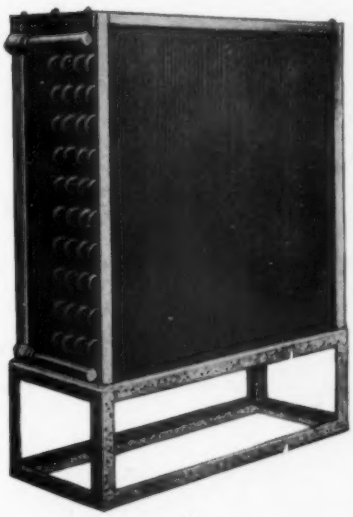


FINNED COOLERS

FOR :—DISPLAY CASE, COMMERCIAL and INDUSTRIAL APPLICATIONS



FINNED COOLERS
FOR AIR-CONDITIONING APPLICATIONS



FINNED TYPE
AIR COOLED CONDENSERS

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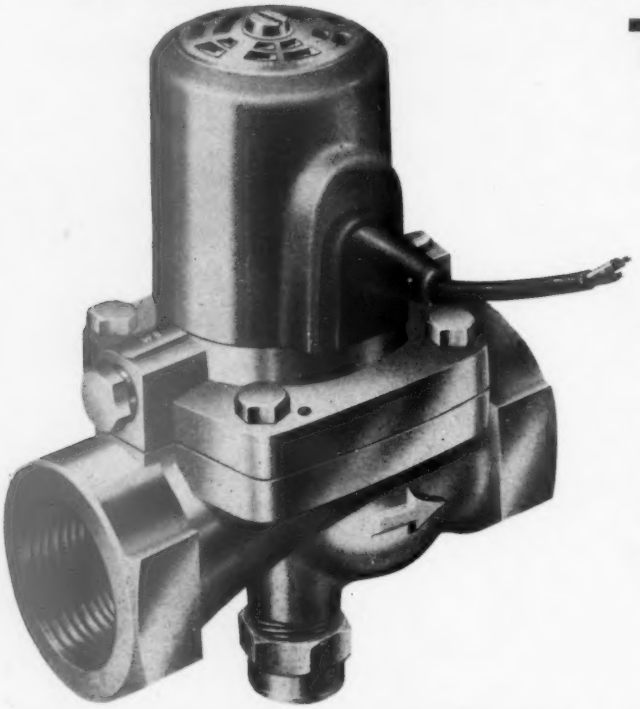
Danfoss ANNOUNCE NEW

SOLENOID VALVE FOR BRINE & WATER

TYPE EVD



DESIGN

The valve body is of red metal. The armature is of stainless steel. The valve plate and diaphragm are made of synthetic rubber.

The valve plate is spring loaded, ensuring complete tightness and rapid closure of the valve.

The coil housing is supplied in :

DESIGN A, with strain-relieving grommet for coil cable,

DESIGN B, with holder for flexible tube connection for coil cable.

FULL PARTICULARS ON APPLICATION.

Type	Connection FPT	To be used for	Electrical Data			Opening differential pressure*		Max. permissible pressure	Stem for hand operation	Code No.**	
			Watts	Voltamp. Surge	Voltamp. Steady	Min.	Max.			Design A	Design B
EVD 20	3/4 in.	water and brine within the temperature range −4 14°F (− 10°C) to + 194°F (+ 90°C)	8	38	15	4.3 psi. (0.3 atm.)	114 psi. (8 atm.)	171 psig. (12 atm. ga.)	without	32U0216	32U0220
EVD 25	1 in.								with	32U0232	32U0236

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Manufactured by

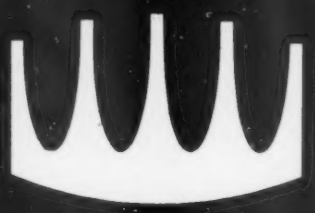
Goodlass Wall & Co Ltd

THE CORN EXCHANGE LIVERPOOL 2

OR 179/185 GREAT PORTLAND STREET LONDON W1

Paint Specialists since 1840

The reason for our



When you make the world's top refrigeration you need a fitting symbol. Hence the FrigidaireCrown. There have been many changes in the refrigeration world since we chose it— many of them made by Frigidaire. But if we had to choose our emblem anew, we should still choose the Crown. After all, we do make the best.

...and here's what the Frigidaire means to YOU!

You get prestige, with Frigidaire equipment—the prestige of serving from a make *everyone* respects. But you get more than prestige. You get things like these . . .

The benefit of THIS kind of know-how

Proprietary Perfumes Limited, The Central Perfumery Organization for Unilever Limited, called in Frigidaire to solve a problem in their distillation plant. Uncondensed vapour was contaminating the lubricant in the vacuum pumps.

Refrigerated vapour-traps seemed to be the answer, so Frigidaire co-operated with Proprietary Perfumes Limited to set up a pilot scheme. It was entirely successful, and thirty stills have since been built incorporating Frigidaire's installation. Now the pumps need dismantling only once in three months, saving Unilever time and money. *This* kind of know-how benefits *your* kind of refrigeration.

Refrigeration you can trust completely

Proof of this is that time and again you find Frigidaire installations doing jobs where reliability is vital. Just one example—the Frigidaire units you find preserving life-and-death drugs, in so many hospitals!

Your Frigidaire Distributor is YOUR OWN expert!

As a Frigidaire-user you are in a unique position. As well as having the world's finest refrigeration equipment, you have virtually a complete "Frigidaire organization" to give advice and service. Our reputation is ensured by every Distributor giving you *complete* Frigidaire service—day and night.

JUST ONE FRIGIDAIRE INSTALLATION TO INTEREST YOU!

Fortnum & Mason chose Frigidaire for the new provisions hall of their fine Piccadilly shop. It wasn't just a matter of trouble-free refrigeration. The units *had* to blend with existing decor. So special oak-panelled cabinets were produced, combining latest cooling techniques with exquisite woodwork. Just one example of Frigidaire versatility, and the specialized service we offer our customers. (We also provide refrigeration for Fortnum's flower room and new travel patio!)

FRIGIDAIRE

REGD. T.M.

The refrigeration name everyone respects

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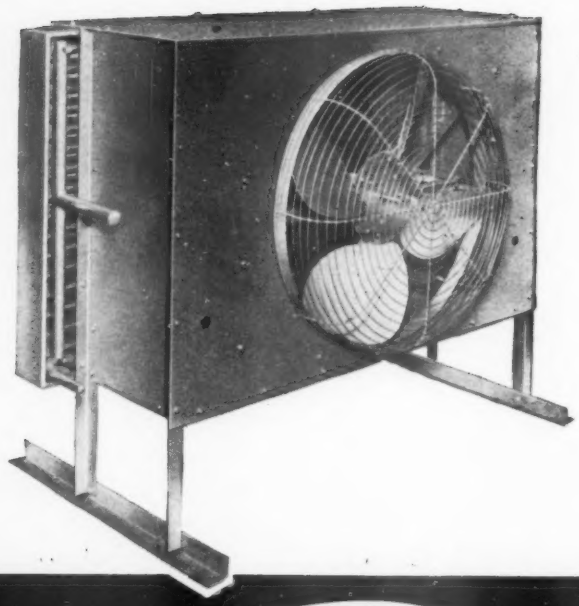
AIR-COOLED CONDENSERS

WITH INNER-FINNED TUBING



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RANGING FROM 60,000 TO ONE MILLION BTU/HR

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Teddington

Type RD Thermostatic Expansion Valve

FOR FREON 12 AND FREON 22

- ✻ Self-contained—no capillary or phial
- ✻ Definitely non-reversing under all conditions
- ✻ Can be used on low capacity plants without 'hammer
- ✻ Limit-charged, giving overload protection to motor on starting
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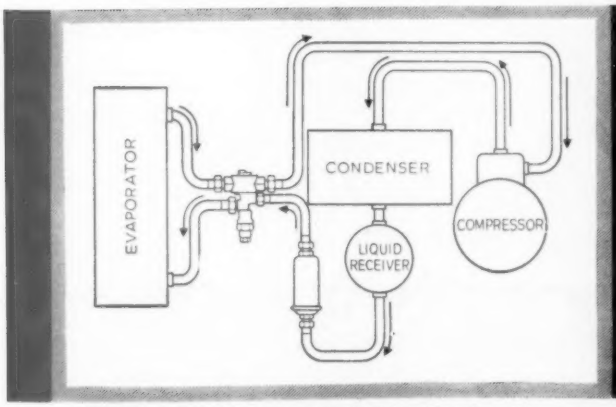


Typical Vapour Compression Refrigeration Circuit incorporating Teddington Type RD Expansion Valve

The ideal unit for:

REFRIGERATED VANS

INDUSTRIAL HERMETICALLY SEALED UNITS

BLOWER COIL INSTALLATIONS

SYSTEMS USING HOT GAS DEFROSTING

For further technical information write for leaflet TRC 9

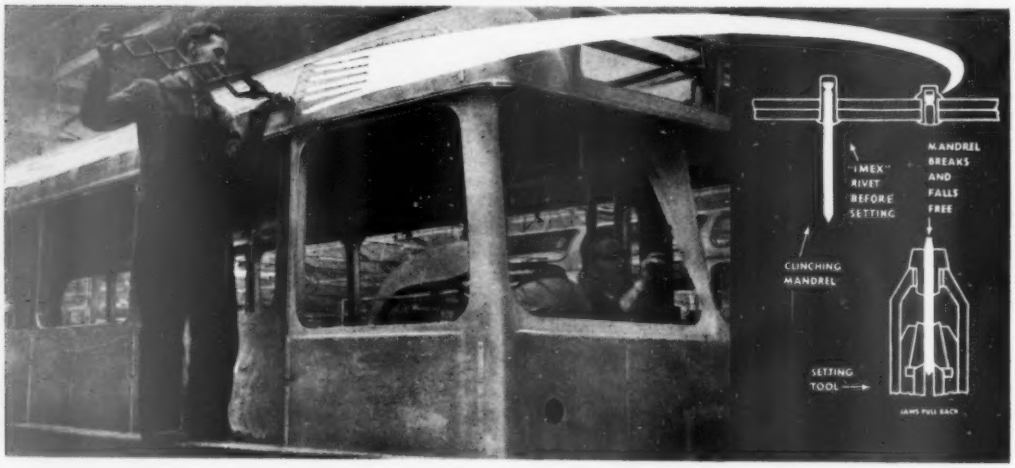
TEDDINGTON REFRIGERATION CONTROLS LIMITED

SUNBURY-ON-THAMES · MIDDLESEX **SUNBURY-ON-THAMES 456**

AUTOMATIC Teddington CONTROLS

TT99

when you need
WATERTIGHT OR AIRTIGHT FASTENERS
choose
'IMEX' BLIND RIVETS



The 'Imex' Rivet offers all the advantages of the well known Tucker 'Pop' Rivet in that it can be set by one operator, in one operation, working from one side of the material only.
The additional advantages of the 'Imex' Rivet are that it has a sealed end and this combined with a high rate of radial expansion in setting ensures a joint which is vibration proof and pressure tight Also a completely flush finish to the rivet can be obtained if required.

'Imex' Rivets are manufactured from aluminium alloy and copper, and are available in diameters of 1/8", 5/32" and 3/16" for riveting material up to 3/8" thick.
The riveting of bus roofs shown above is typical of the many applications where the 'Imex' Rivet fills the need for a speedy, economical watertight sheet metal fastener.
Photos by courtesy of W. Alexander & Co. Ltd., Falkirk and Scottish Omnibuses Ltd.

Geo. **TUCKER EYELET** Co. Ltd.
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The trade mark 'IMEX' is registered in respect of rivets in the United Kingdom and many other countries in the name of Geo. Tucker Eyelet Co. Ltd

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- Crystal base seals.
- Refrigerator seals.
- End seals for cylindrical components.

Write for publication MK/153 which gives details of these and other STC Hermetic Seals.

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61/8MK

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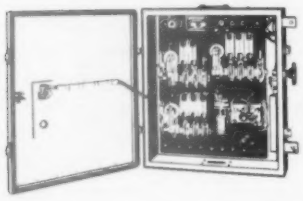
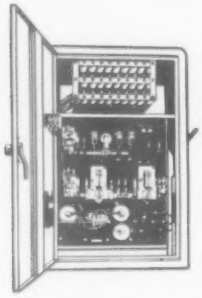
TF Series



TS Series



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air conditioning and refrigeration equipment

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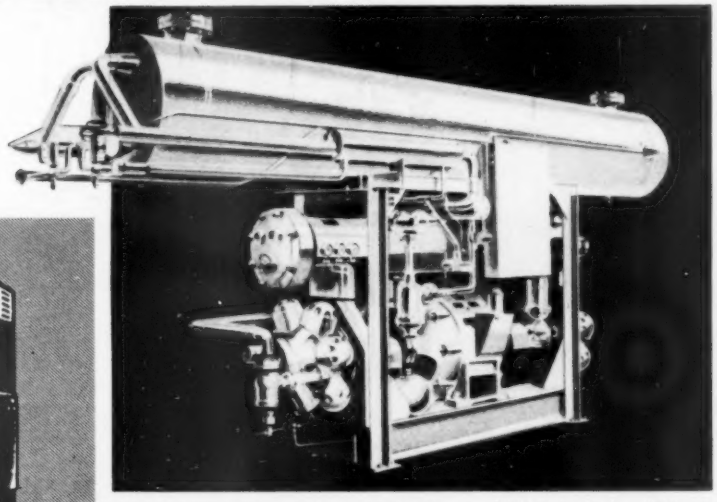
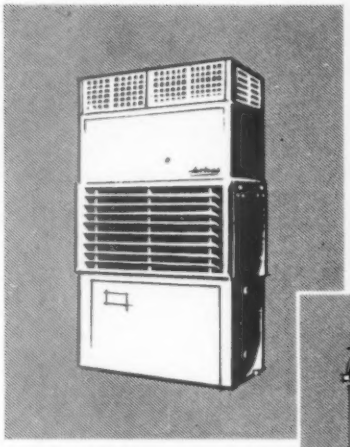
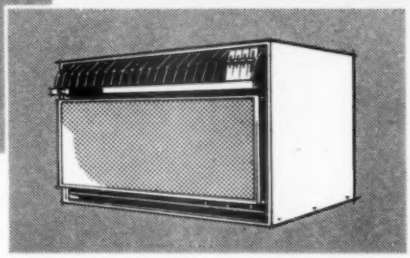


'W' Series Packaged Liquid Chiller, single and dual systems 15-100 HP



Packaged Unit — water and air cooled motor 3-15 HP. Complete with sealed motor compressor.



S11 — 13 Room Unit A range of capacities through from 8,000 — 28,000 B.T.U. at Standard Conditions.

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(please tick)

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COMPANY _____

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VACANCY for qualified and experienced service engineer for commercial refrigeration in the East Midlands A well appointed flat is available, suitable for married couple, without children. Write to Fred Hawkes (Refrigeration) Ltd., Polar Works, Park Road, Rushden, Northants. 176

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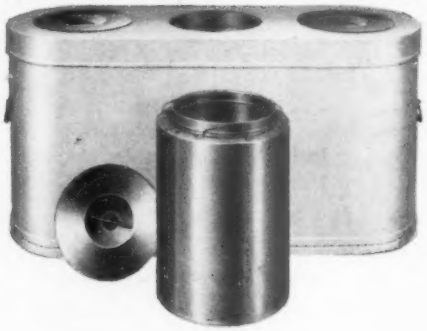

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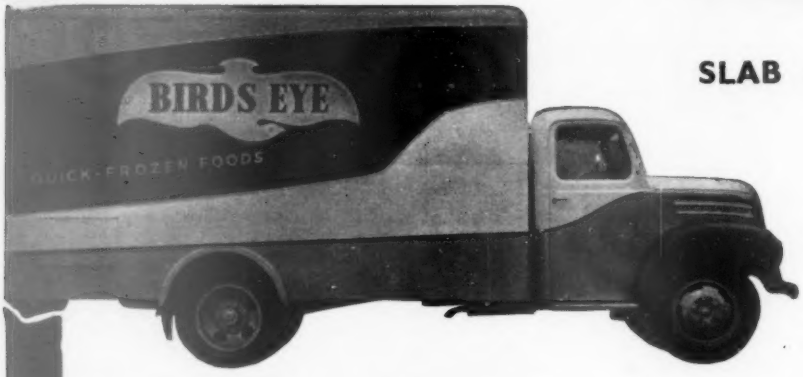

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VOLUME 65 NUMBER 758

JUNE · 1961

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Editorial...

Interplas

N.Z.'s Engineering Development

BEAMA'S Golden Jubilee

● Visitors to the International Plastics Exhibition and Convention, to be held at Olympia from June 21 to July 1, will quickly realize that the plastics industry is once again moving into top gear. Although 1960 returns showed that production at 560,000 tons was only 12 per cent. above the previous year's output, and consumption within the U.K. was 20 per cent. up, these figures by comparison with gains shown in preceding years were construed as a mild recession for the industry.

● As one of the best customers of plastics firms, the refrigeration industry is naturally deeply interested in the forward march of this important business. Thus, coincident with the Interplas Exhibition, is published this special plastics number of MODERN REFRIGERATION.

● Those persons who regard New Zealand as a land almost entirely concerned with primary production will find most enlightening an article in *Engineering* for May 26. After tracing the early development of engineering in the Dominion, when it was in the hands of the blacksmith, the shipwright and the millwright, the writer points to the decline of the gold mining industry, the development of refrigeration and the advent of the internal combustion engine for industry and also of hydro-electric power as having had profound effects on the New Zealand engineering industry. It proved itself versatile and adaptable in meeting the demands made upon it. Many steam engines and small ships were built between the 1870's and the end of the First World War. The manufacture of oil engines was increasingly important from the turn of the century, but further development was arrested by expansion in the use of electricity after 1920. The agricultural industries expanded rapidly when refrigeration of perishable foodstuffs made it possible to sell meat and dairy produce profitably 12,000 miles away, and this expansion provided wide fields for New Zealand engineering.

● U.K. exporters of machinery will view with some misgivings the above writer's final conclusions that "future development in New Zealand's engineering industry will include increased manufacture of machinery and equipment for such activities as refrigeration, transportation, food preservation and packaging, goods handling, earth moving, and various branches of agriculture and dairying. New Zealand will manufacture for export goods based on domestic raw materials and a wide range of the products of New Zealand skill as applied to imported raw materials. The next 20 years will therefore see a great expansion into new fields of mechanical engineering. New Zealand will develop to a much greater extent its ability and capacity to manufacture industrial machinery and equipment to the orders of customers both at home and abroad."

● From another part of the earth's surface "marked red" comes the intriguing news that a plant is to be set up to process flying fish. The Government of Barbados have approved plans for a new combined abattoir and cold storage plant for flying fish to be built at Bridgetown. It will enable the Barbados Government to consider marketing flying fish in consumer packs, with possible export to other of the islands, thereby strengthening the Barbadian economy. The abattoir and the flying fish plant will, of course, operate completely independently. The abattoir is designed to handle 15 to 16 tons of dressed pigs, sheep and cattle per week, the tripes and offal being processed in an associated by-products plant for conversion to fertilizer or for disposal. The flying fish plant incorporates fish icing and freezing equipment with a total cold-storage capacity of 260 tons. The quick-freezing plant is capable of freezing at the rate of 1 ton of fish in two hours. Once the plant has been established, consideration will also be given to the provision of mechanical fish filleting equipment but initially a pilot plant, employing hand filleting, will be operated to establish the market potential. A retail shop, in addition to wholesale trade facilities, is to be provided as part of the cold storage plant. Plant will be ordered by the Crown Agents; consulting engineers are Brian Colquhoun and Partners.

● The British Electrical Power Convention, of which the B.R.A. are members, makes its third visit to Eastbourne, for its thirteenth annual meeting from June 12 to 15, under the presidency of Sir John Pickles, B.Sc., M.I.E.E., chairman of South of Scotland Electricity Board. The convention proceedings, which will take place in the Winter Garden, have as their theme this year "Electricity in Prosperity and Welfare of the Nation." The convention is representative of all the principal organizations, 42 in number, connected with the British electrical industry and is a direct successor of the Incorporated Municipal Electrical Association's Convention, whose 52nd and last meeting was held in Eastbourne in June, 1948. The convention will draw to Eastbourne over 2,000 people from all parts of Great Britain, Northern Ireland, the Isle of Man and the Channel Islands.

● One of the four papers to be read at Eastbourne is entitled "British electrical manufacture in the national economy" and will be presented by Mr. S. F. Steward, C.B.E., M.I.Prod.E., the director of the

British Electrical and Allied Manufacturers' Association. 1961 is the golden jubilee year of the British Electrical and Allied Manufacturers' Association and this paper links the trade association with the growth and development of the industry; it opens with a history of BEAMA and an account of the results of co-operation in the electrical industry during the fifty years since 1911. This is a significant period in Britain's industrial history covering as it does almost the whole development of the electrical industry as we know it to-day. It has seen a number of remarkable achievements which have had a profound effect on our national economy and our standard of living. In the following section the paper examines the present structure of the British electrical manufacturing industry. It shows the vital role it plays in production, efficiency and living standards at home and the major contribution it makes to British exports. The range of the industry is enormous, ranging as it does from small domestic appliances and electronic equipment to electric locomotives, giant transformers and 500,000 kW turbo-generators. All sectors are having to adapt themselves to the new conditions arising from technical advances and commercial changes.

● Our picture of the month for June highlights the growing importance in the home of the food freezer. The home freezer can be found in many forms, the reach-in chest type, the upright drawer type or a combination freezer/refrigerator which is the model in question illustrated. The British market for this product is being attacked from the west by the United States and Canada and from the east by Sweden and Western Germany. Whirlpool Corporation in the United States has recently developed two new economy-model combination refrigerator/freezers in the company's line of electric refrigerators. One is a 13.9 c.ft. top freezer model (illustrated on page 571), the second a 13.8 c.ft. bottom freezer unit, both featuring large capacity convenience and economy. The larger model supplies "activated air," a device that provides longer food preservation by constantly circulating air throughout.

● The U.S. air-conditioning and refrigeration industry continues to be a bright spot in the nation's over-all business picture, its leaders agreed last month, surveying the final figures for 1960 and preliminary reports for the current year. While gains have not been so spectacular as in some of the early years of the 50's, when the industry was feeling the effects of the post-war boom, it has continued to show progress over a period when many other segments of the economy have suffered set-backs in varying degree, it was pointed out by R. K. Serfass, president of the Air-Conditioning and Refrigeration Institute, trade association of the industry, whose board of directors opened a two-day session in Hot Springs, Va, to lay plans for Institute activities during the coming season. In the field of unitary air-conditioning, which includes all central residential equipment, as well as some smaller commercial and industrial applications, manufacturers shipments in 1960 totalled some 336,000 units, an increase of about 10 per cent. over the 1959 figure. More than 60 per cent., or about 215,000 of these went into residential installations, the Institute estimates. Shipments in the first quarter of 1961 are up some 20 per cent. over the corresponding period of 1960. It was pointed out that the growing trend towards construction of air-conditioned low- and medium-priced homes by speculative builders probably will contribute toward a steepening of the curve representing sales of this type of equipment. Large "systems" installations, such as those used in big office buildings, industrial plants, hotels, apartments, stores, and similar multi-room structures, showed an increase of about 12 per cent. in 1960 over 1959. Total installed cost of these systems last year is estimated by ARI at $800,810,000, compared with $716,570,000 in the previous year.

DoRDeC's NEW OFFICERS

At the last quarterly meeting of DoRDeC Mr. M. A. Craig, Electrolux Ltd., was unanimously elected chairman of the Domestic Refrigeration Development Committee in place of the late Mr. E. G. Rowledge. Mr. Craig was formerly vice-chairman and by the unanimous vote of the members Mr. W. Roxburgh, Morphy-Richards Ltd., was elected vice-chairman to succeed him.

WESTINGHOUSE IN U.K.

Westinghouse air-conditioning equipment is to be marketed for the first time in this country under an agreement just announced between the Westinghouse Electric International Company of New York and Hall-Thermotank Ltd. The equipment will be marketed by the International Products Division of Thermotank Ltd., which recently opened new offices at 60 Rochester Row, London, S.W.1, and now claims to offer the most comprehensive service available from one source to the air-conditioning, heating and ventilating industry. In addition to the new Westinghouse equipment, Thermotank's I.P.D. also market a wide range of air-conditioning products manufactured by J. & E. Hall Ltd., Thermotank Ltd., and various companies outside the Hall-Thermotank Group.

OBITUARY

Mr. A. S. Juniper, C. Inst R.

We announce with deep regret the passing last month of Mr. A. S. Juniper at the age of 91. Mr. Juniper founded the firm bearing his name in 1909, in the Japanese Village, Smithfield and remained chairman until his passing. He was closely associated with the City of London, being elected a member of the Court of Common Council in 1920 and was Chief Commoner in 1935. In 1939-40, he was president of the City Livery Club.

NEWS OF THE MONTH

Refrigeration and A-c Exports.—During April, 1961, air-conditioning and refrigerating machinery and fans (commercial and industrial sizes) to the value of £870,691 weighing 1,326 tons were exported from the United Kingdom. Comparable figures for April, 1960, were 911 tons, worth £702,062.

* * *

Exports' Analysis.—Of the 1,326 tons of air-conditioning and refrigerating plant worth £870,691 exported by Great Britain in April—quoted in the preceding paragraph—35 tons went to the Union of South Africa, 32 tons to India, 30 tons to Australia, 33 tons to New Zealand, 52 tons to Canada, 231 tons to "other Commonwealth countries," 99 tons to Eire, 36 tons to Sweden, 151 tons to Western Germany, 53 to the Netherlands, 107 tons to Belgium, 65 tons to France, 24 to Italy and 378 tons to "other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigeration machinery during April, commercial refrigerating machinery accounted for 179 tons worth £92,186, industrial plant and equipment for 248 tons worth £122,185, and refrigerating machinery, equipment and parts for 527 tons worth £384,143.

* * *

Exports of Small Refrigerators.—During April, 1,422 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £845,947. The 1,422 tons comprised 23 tons to the Union of South Africa, 17 tons to Rhodesia and Nyasaland, 44 to New Zealand, 114 tons to Canada, 362 to "other Commonwealth countries and Eire," 86 tons to Sweden, 87 tons to Western Germany, 26 tons to Italy and 663 tons to "other foreign countries."

* * *

The Shaw Savill Company has ordered two more refrigerated cargo ships for the London-Australia service via Suez and the London—New Zealand service via Panama. The ships, each of 13,000 tons and with a speed of 18 knots, are for delivery before July, 1963.

The imposing new showrooms and headquarters recently opened by H. C. Troldahl Ltd., in Newcastle upon Tyne.

Mr. John Sherlock, the chairman and managing director of The British Thermostat Company recently gave a party attended by over 100 long service employees in honouring his personal secretary, Mrs. C. Hunter, who has retired after 30 years' service with the company. Mr. Sherlock said that the firm had benefited from knowing Connie Hunter. He also made the presentation of farewell gifts.

* * *

Export and Import Bank loans were recently announced to Industrias Integradas, Venezuela. They will manufacture and assemble auto parts, stoves, and refrigeration and air-cooling equipment.

1961 Cryogenic Engineering Conference

August 15, 16 and 17, 1961
Ann Arbor, Michigan

THE 1961 Cryogenic Engineering Conference will be sponsored by the University of Michigan and will be held in Ann Arbor, Michigan, on August 15, 16 and 17. Plans are now being made to assure a comfortable and enjoyable meeting for all delegates. Preregistration information and a copy of the programme will be available the latter part of July, 1961.

Papers varying in length from 5 to 25 minutes will be presented at the conference dealing with the technical aspects of cryogenic engineering in the field below 150° K. Short topics will be grouped in a special session.

Papers at previous conferences have dealt with liquefaction cycles, purification of gases, gas separation, distillation, heat transfer, catalysis, fluid flow, absorption, hydrogen and LOX production, cryogenic fuels, oxidants, pressurants, missile problems, mechanical and thermal properties, vacuum insulation, powder insulation, super insulation, safety, friction studies, vapour-liquid equilibria, liquid level devices, probes, pumps, bearings, transfer lines, dewars, cryostats, temperature and pressure measuring devices, expansion engines and turbines, heat exchangers, regenerators, high energy and nuclear applications, bubble chambers, etc. This list is certainly not complete. The conference committee welcomes and encourages papers on other fundamental cryogenic subjects.

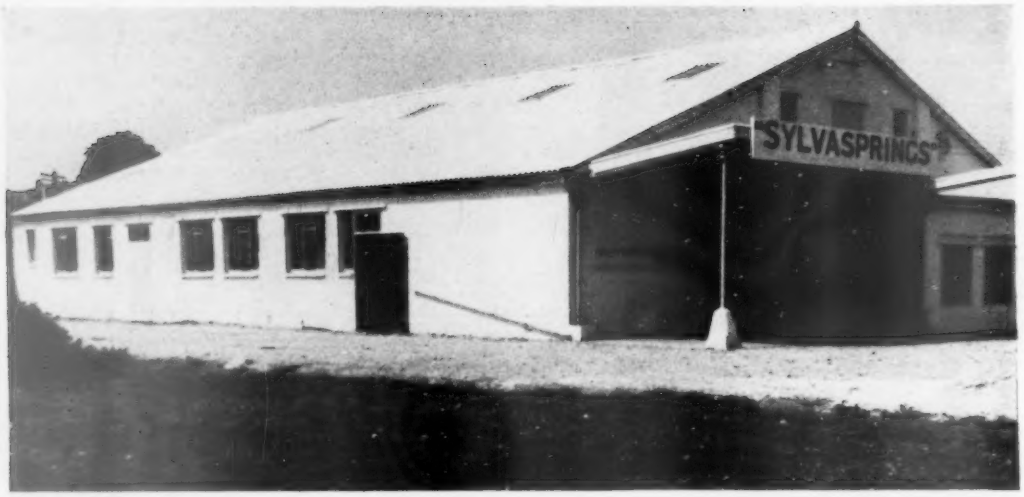
REFRIGERATED TRANSPORT IN AUSTRALIA

THE first Freighter Industries refrigerated van with Perkins-engined Transicold equipment has just been put into service in Australia. The Freighter/Trailmobile insulated van is owned by the transport firm of G.N. Blomfield Pty Ltd., of Red-Hill, Victoria. The unit has been operating on 1,300-mile trips to Brisbane, carrying 15 ton loads of perishable goods, completing the journey in 36 hours. It is similar to units successfully operating in the United States, Mexico and Canada. The Transicold refrigeration plant is fitted with a four-cylinder 1·6 litre Perkins Four 99 diesel engine, rated for this purpose at 23·5 b.h.p. at 2,000 r.p.m. The engine is mounted on shock absorbers and hung from brackets beneath the van.

PICTURE OF THE MONTH

The marketing of home-freezers, whether as combination units with refrigerators or as free-standing horizontal or vertical models, is showing a steeply-ascending curve in the U.K. This new U.S. combination type holds an amazing quantity of frozen food.

(See also p. 569.)



Watercress Cooling Improves Appearance

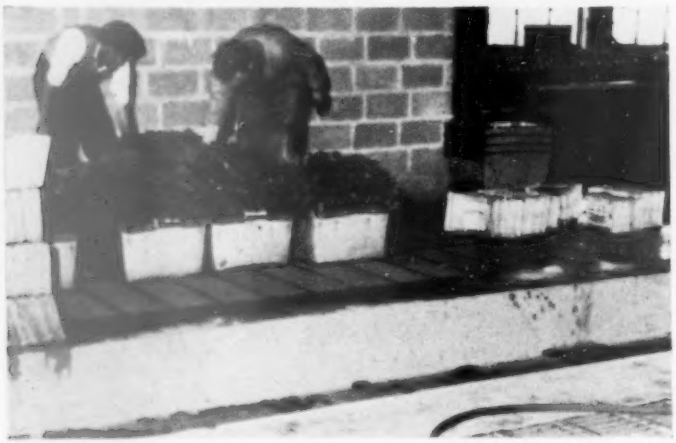
EUROPE'S largest watercress growers have turned to the services of refrigeration to enable them to market this vegetable in pristine condition.

Bedford and Jesty Ltd. of Bere Regis, Dorset, who have been producing watercress since 1896, have lately built a new packing station incorporating a completely automatic feed line that calls upon refrigeration at several points. Mr. J. B. Jesty, managing director, designed the layout of the new plant and supervised the manufacture of much of the equipment in his own workshops. Dexion steel slotted angle material was chosen as the constructional material for much of the line.

William Bedford came to Bere Regis 65 years ago because of the abundant supply of pure spring water in this area. This is the essential requirement for the successful cultivation of watercress. The water rises from the ground in natural springs and through artesian boreholes sunk especially for the purpose. The water is rising from a depth of between 80 and 200 ft., and consequently emerges at a constant temperature of 52°F. all the year round. Whilst the water naturally cools as it flows through the beds in winter, the fact that the temperature at the source is relatively warm makes it possible in this country to market cultivated watercress all the year round. The beds are carefully graded to an even slope to ensure a constant even flow of water through the crop. The banks are sealed with concrete walls to ensure that there can be no drainage of surface water into the beds. At the outlet of the beds the water flows into the nearby stream, but none of this river water can enter the beds.

"Sylvasprings" watercress, the first gathered from the cultivation beds covering 32 acres, in and around the quiet Dorset village of Bere Regis, arrives at the packing station in containers which, when full, hold about 60 lb. each.

After being washed under sprays it is passed to the "bunchers" who are skilled at selecting and bunching the watercress at rates up to 400 bunches per hour, these bunches, following a final trim, being packed into chip baskets. They are then placed on a gravity conveyor which carries them to two hydro-cooling tanks into which they are automatically fed and through which they travel at a predetermined speed in chilled water controlled at approximately 36°F. J. & E. Hall Ltd. were responsible for the refrigeration installation.

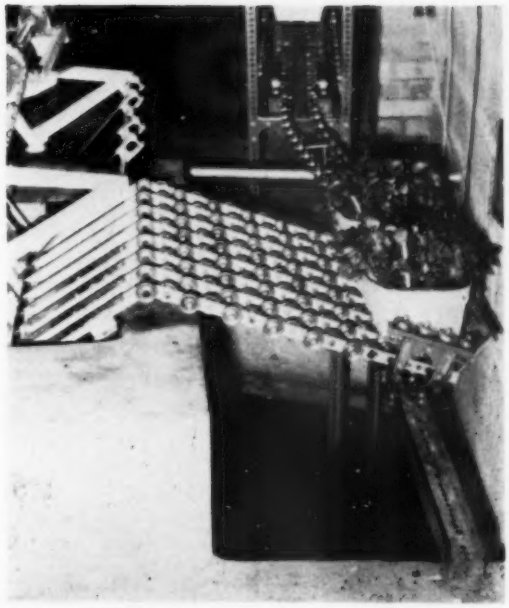


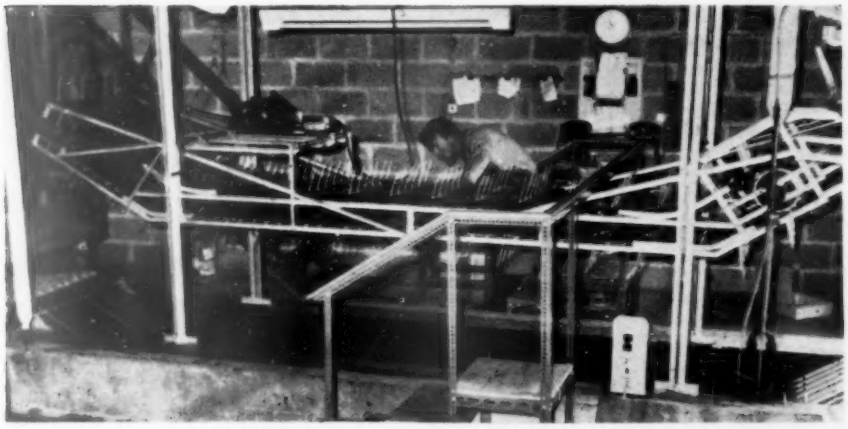
Containers arriving at the factory from the beds; each holds about 60 lb. of watercress

Design of Hydrocooler

The cooling of the water is achieved by a submerged grid battery evaporator unit, constructed of galvanized steel tubing, in the bottom of each tank beneath a horizontal baffle, with forced water circulation obtained by a single stage centrifugal pump direct-coupled to a ¼ h.p. electric motor, each tank being equipped in this way. The cooling plant includes one Hallmark model 6CP/10R condensing unit comprising a 6-cylinder, pump-lubricated compressor, an oil separator and a 5 h.p. electric driving motor; this equipment is mounted on a common baseplate, together with a remote air-cooled condenser complete with propellor type diaphragm mounted fan and special large capacity liquid receiver. This plant works in conjunction with the two previously mentioned evaporator units, with a servo-operated back pressure regulating valve actuated by a constant pressure pilot valve, fitted in the common suction pipe to prevent the formation of ice on the evaporator surface.

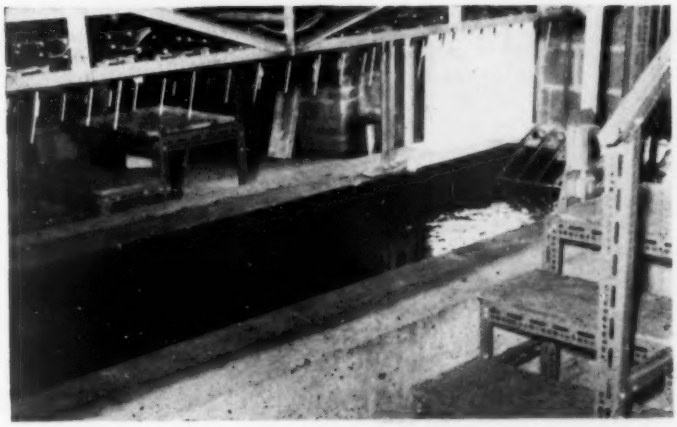
The operation of the equipment is safeguarded by





Above: On its Dexion conveyorized journey through the plant each chip is halted at the "T" junction and then automatically lifted for a right-angular descent into the hydrocooler.

Above: The conveyor through the hydrocooler is lifted clear for cleaning each day.



Right: The hydrocooling tank.

Mr. J. B. Jesty, managing director, who designed the factory.

high and low pressure safety cut-outs, also an oil differential switch to ensure adequate lubrication of the compressor.

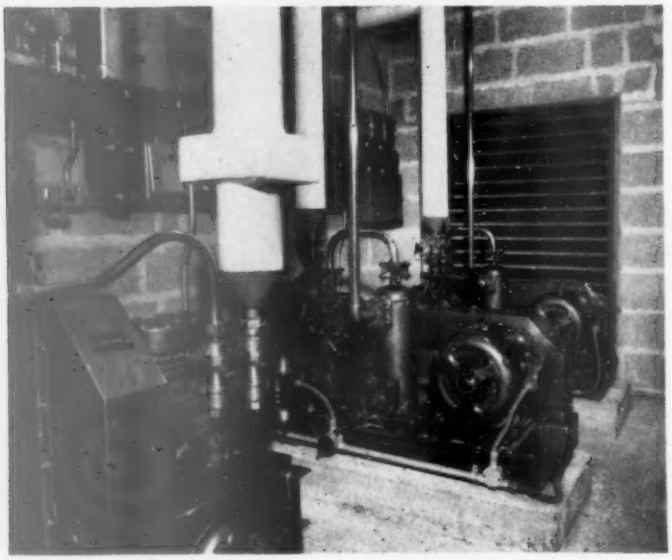
When the chips arrive at the far end of the tanks they are raised on to a table where flake ice is introduced between the bunches. This flake ice is obtained from a model 1A "Hallflake" automatic ice maker. In this ice-maker a uniform flow of water from a spray header is transformed into a thin layer of ice on the inner cooling surface of a vertical cylindrical freezing drum and the sub-cooled dry ice is removed, in a continuous process, by a revolving cutter.

In this instance a Hallmark model 6CP/9R air-cooled condensing unit driven by a 5 h.p. motor is used which has a slightly smaller remote type condenser than the hydrocooling unit mentioned above.

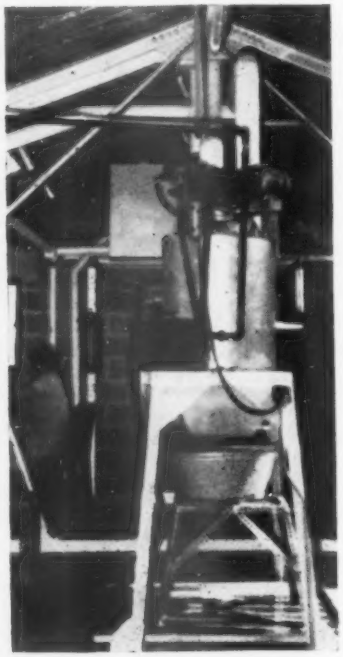
With flake ice included, as a convenient form of latent refrigeration to serve the cooling requirements during the later transit period to the various markets, the lids of the chips are finally secured by a tying machine and the chips again travel by gravity conveyor to a position convenient for introducing into a refrigerated chamber, where they are stored until ready for despatch.

The air temperature in the insulated chamber is automatically controlled between the limits of 33°F. to 37°F. by means of a Hallmark model 3C7 condensing unit. This consists of a belt-driven, triple cylinder compressor, delivery oil separator, air-cooled condenser battery, liquid refrigerant receiver and a 3 h.p. electric motor with direct-coupled condenser fan, mounted as a complete unit and connected to two extended surface forced draught ceiling mounted air cooling units. These have been specially selected to give a resultant relatively high humidity within the chamber to reduce dehydration of the produce to a minimum during the storage period.

Refrigerating machinery room.



Flake ice-maker in the roof space.



The Refrigerated Robot

COOLED DISPENSING MACHINE NOW BIG BUSINESS

A GREAT variety of new and unusual machines were shown at the **Third International Vending Exhibition,** held at the New Horticultural Hall last month. Refrigeration naturally featured prominently, not only in the cold drink machines but in the "cold buffet" and other similarly original venders.

The **British Automatic Co. Ltd.,** contrived a comprehensive exhibit which included a number of their machines; this was in the form of a fully automatic working cafeteria. Among the machines shown and demonstrated by the B.A.C. were the Gloster VM 35 milk vending machine, which can offer up to four selections of cartoned drinks; the Gloster Candy machine VM22; and the Gloster Pastry vender VM25. A Sankey "Vendo" ice cream machine was also seen in operation.

Ditchburn Vending Machines Ltd. showed their "Colespa" which is designed to provide a choice of seven refreshing drinks. Its specially designed $\frac{1}{3}$ h.p. refrigeration unit keeps the drinks ice-cold 24 hours of the day. Drinks are served either carbonated or still and the degree of carbonation can be adjusted to suit each individual flavour.

Electric Shop Developments Ltd. showed only one machine, their "electRobot" fully automatic shop. This sells 24 lines of all kinds of mixed merchandise, providing the items are wrapped, packaged, bottled or canned, at any price between 1d. and 15s. 11d. Any amount of change can be given between 1d. and 15s. 11d. and the machine will accept the maximum sum stated, in any combination of sixpences, pennies, florins or half-crown pieces. Up to 15s. 11d. may be inserted in the machine in advance, and the machine will total and show the sum that has been deposited, on a screen. As each purchase is made the cost is deducted from the credited amount and the balance is indicated. Money may be added at any time to increase the credit during purchases. Furthermore, change for the amount shown may be returned by the press of a button at any time. Refrigeration is available on any standard model.

Fisher and Ludlow Ltd. included their pre-mix vender on their stand which offers a choice of two different drinks with a capacity for dispensing 500 seven oz. cup drinks. Their bottle vender was also on display. This can sell up to five different products, 50 ice-cold bottles being in the "ready to sell" position, and a further 25 bottles in pre-cool storage.

In addition to their established range of automatic vending machines, **Gloster Equipment Ltd.** exhibited several new venders, including a multi-selection refrigerated carton vender. Their VM36, also shown, is a floor-standing model, constructed to fit into a "bank" of Gloster vending machines. It has a capacity of 300 six oz. cups. It is equipped with a refrigerated unit which allows fresh dairy milk to be used in the dispensing of drinks. Gloster's VM35 is the new multi-selection refrigerated carton vender designed to accommodate up to 304 cartons, and it can vend any type of carton that is in production at the present time. For vending sandwiches, salads, fruits, snacks, packaged desserts and dairy products of every kind in liquid, solid or semi-liquid form, there is the Gloster VM37, which also includes special features: an automatic timing device which alters the display panel every 30 minutes, and a 6d. to 3s. 6d. price range, with four combinations. This vender is refrigerated, electrically operated, and has a capacity of 130 items.

Rollason Aerocessories Ltd. showed their "Evva" range of drink vending machines. These are post-mix machines which are available to vend either ice cold carbonated, ice cold still or hot drinks from a main water supply, only the syrup concentrate being stored in the machine. This system enables the quality of the drink to be maintained, an important feature when vending proprietary drinks of national and international repute. A feature of the machines is extreme compactness, 300 7 oz. cup capacity being

A "bank" of Gloster vending machines installed in a canteen. (Left to right): VM.2 refrigerated milk vending machine, VM.22 candy vender, VM.21 cigarette vender, VM.37 refrigerated general merchandizer, VM.36 hot beverage vender, VM.25 sandwich and snack machine, VM.2 refrigerated soft drink vender.

contained in a machine 17 in. wide, 20 in. deep, and 5 ft. high. Unit construction within the machine simplifies servicing. New features displayed were an electrically operated cup mechanism of 300 cup capacity and a syrup dispensing pump unit. Both of these units will be available to manufacturers wishing to build them into their machines.

A cold vender was introduced by **W. M. Still and Sons Ltd.** With total capacity of 85 items, 17 in each of its five columns, the machine can offer a choice of five different items at the press of a button. When a column empties, a " sold out " sign is automatically illuminated. In common with all W. M. Still's automatic vending equipment, the coin mechanism is adjustable to the price of the items. Also on exhibition was their automatic soft drink vending machine which dispenses between 150 and 200 chilled orange, lemon or lime juice drinks from 1 gal. of flavour concentrate, according to the desired strength. Other

W. M. Still's automatic refrigerated vender.

exhibits included the hot food machine, which is equipped with a timing device to keep the food refrigerated until 50 minutes prior to the pre-arranged mealtime. Then the refrigerator cuts out and the heating element is automatically switched on. Two choices of meals can be offered with a total capacity of 52 platters. Also displayed was the cold buffet machine, incorporating a built-in refrigerator to maintain a temperature of 50 °F., which can accommodate up to 400 sandwiches, offering 10 selections.

Most interesting exhibit at the **Venders and Renters Ltd.** stand was the extensively modified and improved version of the Wistoft heated and refrigerated compartment (plate-size) venders. Designed chiefly for use in industrial canteens, there are eight compartments to every column and it is suggested that banks of columns should be built into the normal wall between the kitchen and canteen. This would eliminate the old fashioned method of serving ; all food is covered and kept free from dust, etc., until the consumer removes it from the compartments. Only one compartment can be opened at a time, on the insertion of the appropriate coinage. A column can be heated or refrigerated and installed so that the same columns can perform either function. Thermostatically controlled infra-red tubes, fitted to the sides of the compartments, are used for heating, and sealed refrigerator units with blower type pressure operated coils, also thermostatically controlled, maintain a cooling temperature that is normally 40 °F.

Prestcold exhibited a range of rotary condensing units of $^1/_{11}$ h.p., $^1/_8$ h.p. and $\frac{1}{4}$ h.p. Prestcold condensing units are supplied for use with capillary or thermostatic expansion valve control systems and incorporate a unique rotary motor-compressor having only three moving parts. The compactness of their design allows the unit compartment size to be reduced to a minimum leaving more space for refrigerated storage.

EAST ANGLIA REFRIGERATION ASSOCIATION

A LECTURE entitled " Recent Advances in the Applications of Refrigeration in the Fish Industry," was presented by Commander M. B. F. Ranken, M.I.MAR.E., A.M.I.N.A.M.INST.R., MEM.A.S.H.R.A.E. of J. & E. Hall Ltd., in the Flixton Room, Norwich recently.

This lecture was given before a well-attended gathering of the East Anglia Refrigeration Association. Among those members present were Commander W. R. Sinclair, president of the Institute of Refrigeration, and Mr. M. E. Edwards, vice-president of the East Anglia Refrigeration Association, and other committee members.

Commander Ranken commenced his lecture with a number of somewhat startling statistics on the world's fish production and the growth of quick-freezing on fishing vessels.

The speaker then outlined the present methods of freezing on shipboard, together with various slides depicting modern installations. The research and mode of future developments were illustrated, with reference to the work of the Ministry of Agriculture and Fisheries. Considerable time was spent on the capacity of the vessels and the change in the length of voyages. The speaker showed very clearly the considerations needed in the positioning of insulated fish holds, with an outline of the insulation methods used.

The effect of power distribution and fuel storage on the fish storage capacity was dwelt on.

Commander Ranken concluded his lecture with some excellent slides on refrigeration in the fish industry, before inviting questions and discussion from the audience.

Discussion

In opening the discussion Commander Sinclair congratulated the speaker on the excellence of the lecture.

Mr. White of C.W.S. asked whether Commander Ranken would suggest from his experience that fishing voyages were going to increase in length and whether he thought the outcome of this would be loss or damage to our traditional fishing ports by ships coming back to other centres.

Commander Ranken replied that he thought this would be the case. It would depend on the facilities there were for dealing with the fish. It sounds crazy to bring a ship into Hull if you want to use the fish in London, so we obviously needed more cold stores in this country. There was in fact a large store for frozen fish, of 1,000,000 c.ft. going up in London.

He said that there was the question of the supply of fishermen and they were, undoubtedly, going to have to go very much farther away. The Greeks, Spaniards, Belgians, Italians etc. already fish on the North African coast and the U.S.S.R., Japanese and Belgians worked in the South Atlantic for hake. We should have to learn to go to the farther waters of the Antarctic, Pacific and Atlantic.

(*continued on p.* 627)

A Special Supplement on the occasion of the
INTERNATIONAL PLASTICS EXHIBITION
Olympia, London June 21 — July 1

PLASTICS IN THE REFRIGERATION INDUSTRY

Mr. E. K. Cole, C.B.E., chairman and managing director, E. K. Cole Ltd.

A Message from the Chairman E. K. Cole Limited

IN recent years, the refrigeration industry has made rapid strides in recognizing the advantages which plastics have to offer when correctly applied and the success of plastics in this field owes much to the intelligent co-operation between the two industries. I am very pleased that my company has been fortunate enough to play a leading part in this co-operation and I am convinced that, together, we can still achieve tremendous strides in the advancement of refrigerator design.

Although the plastics industry can measure its history in decades, it is as yet only at the beginning of an enormous future. It is a complex and rapidly expanding industry, with new raw materials constantly appearing and new applications for these materials arising at an ever-increasing rate.

Plastics have an important role in almost every aspect of our daily lives and it is interesting to note that refrigerators are playing a significant part in the development of this modern and far-reaching industry. In my own company, for instance, some of the most advanced machines and equipment have been chosen with the future needs of refrigeration uppermost in mind. Of the many and varied plastics raw materials so far available, nearly a quarter of Britain's output of polystyrene goes eventually to the refrigeration industry.

In years to come, I believe that the progressive manufacturers of today's refrigerators will be able to take pride in their early recognition of the inevitable supremacy of plastics among the world's raw materials of the future.

THE BRITISH PLASTICS INDUSTRY

Its Growth and Potential*

HOW can Britain's export potential help the Russian seven-year plans, and by expanding trade improve international relations ? Many Russians were able to see for themselves at the British Trade Fair held in Moscow from May 19 to June 4, and the plastics industry was strongly represented. The exhibiting firms obviously did not take the trouble to display their products unless they were convinced there was a real need for them in the Soviet Union, and in this account it is proposed to outline some of the ways in which the two countries may trade to mutual advantage.

The ability to export depends on the growth of a healthy home industry, which in turn depends to a great extent on the ability to earn foreign currency with which to pay for imports. Soviet-United Kingdom trade is already running at a fairly high level. During the eleven months ending November, 1960, the U.K. imported from the Soviet Union, Estonia, Latvia and Lithuania, goods to the value of £66,522,296. The U.K. exported to the same group goods valued at £51,619,343. The expansion in the East-West trade is also reflected in the action of the Moscow Narodny Bank Ltd., which has raised its issued capital from £525,000 to £1,200,000.

More Plastics Exports

The United Kingdom has plenty of experience in the highly competitive field of exports. These, in the first half of 1959, were valued at some £1,636,000,000. During 1959 exports of plastics materials in terms of quantity rose by nearly 28 per cent. over 1958, and in 1960 were higher again—nearly 9 per cent. above the 1959 level.

The pattern of development for the U.K. plastics industry has followed that of other Western countries. Up to the second world war Britain had little to offer, apart from cellulose-based plastics, and thermosetting resins based on coal. The latter differed only slightly from the original phenolics made by Dr. Backeland in 1916, but in the form of laminates had important industrial applications. Much of the early work was carried out by Sir James Swinburn, who was associated with the Bakelite company until 1948. The modern thermoplastics industry really had its birth in 1930, when Industrial Chemical Industries Ltd. started investigation into the effects of high pressure (15,000 to 300,000 per square inch : 1,054 to 21,092 kilograms per square centimetre) on chemical reactions. Experiments were ready by 1932, and in 1935 about a quarter of an ounce (7·08 grams) of a white powder was obtained from ethylene gas. By the end of 1938 1 ton had been made, and in July 1939 a mile (1·6 kilometres) of submarine cable, insulated with the new polyethylene was sunk across the mouth of the Humber river as a test, of electrical resistance, and behaviour under sea water. During the war, the use of polyethylene for radar insulation made a significant contribution to victory, and since that time polyethylene has gone from strength to strength.

Impetus of the War

Under the impetus of the war, development of other thermoplastics was speeded up. Polyvinylchloride was employed for cable insulation and acrylics for aircraft canopies. A great contribution in both the industrial and woven fibre fields was started when the researches of T. J. Whinfield and J. T. Dickson resulted in " Terylene," a polyester of ethylene glycol and terephthalic acid. However, expansion in thermoplastics was delayed by the raw materials situation. Polyethylene was made from alcohol derived from molasses, p.v.c. from carbide. After the war expansion of thermoplastics on a large scale began with the introduction of U.K.-based petrochemical plants which provided a cheap source of ethylene and other olefines. In spite of a few political setbacks, oil was usually plentiful and reasonably stable in price. The cracking units gave propylene for methacrylates via acetone ; oxides of ethylene and propylene for polyurethanes and polyesters, ethylene for polyethylene and (with benzene) for polystyrene. To start with, all polyethylene was made by the I.C.I. pressure system, but 1955 saw the development of Professor Ziegler's low pressure process in Germany, which gave more crystalline, rigid high-density products. A turning point in the history of high polymers undoubtedly occurred when Professor Natta of Italy discovered stereospecific polymerization by which stereoregular materials such as polypropylene were produced. Not only did this system have a profound effect on substances known as " plastics," it had a similar impact on synthetic rubbers, as shown at the recent Second International Synthetic Rubber Symposium in London.

Present State of Industry

The present state of the U.K. plastics industry is a very healthy one. But does this really matter to the average U.K. citizen—the " man in the street " ? Does it affect his standard of living to any marked degree ? The answer is most definitely " yes." It is only necessary to take a look at the window of an ironmonger's shop to see how plastics have taken over the consumer goods market. The ironmonger could now more accurately be called a plastics-monger as the " high polymer age " begins to make itself felt.

Impact of plastics in the consumer industries is matched by the vital importance of both thermosetting and thermo-

* An article prepared to coincide with British Trade Fair, Moscow.

plastic materials to industry. As an example, corrosion costs the U.K. about £600,000,000 in one year, and much of this bill is expected to be cut in the future by even greater use of plastics. In Britain corrosion is being fought by sprayed or dipped coatings, but the use of fabricated ducts and containers made from polypropylene, h.d. polyethylene, rigid p.v.c., p.v.c. reinforced polyester laminates, or perhaps a sandwich construction with a filling of expanded polystyrene or phenolics. New products such as p.v.c.-coated steel sheets for industrial cladding with an expected maintenance-free life of more than 20 years are now available, and even heavy girders for bridges have been experimentally coated in a similar fashion. The aircraft industry employs epoxide-based adhesives for honeycomb cores—this construction was used for the "Bluebird" world's land speed record attempt car. The accident to the car demonstrated beyond doubt the tremendous strength achieved by such adhesives, as only slight damage was caused by the 300 miles (482 kilometres) an hour impacts. Electrical components for rockets and aircraft are usually potted in epoxide resin compounds.

Electrical Applications

The electrical industry employs many varieties of plastics on an extensive scale, due to their excellent combinations of physical and electrical properties. A remarkable achievement in this field was the high vacuum chamber of the "Nimrod" particle accelerator, 164 ft. (50 metres) in diameter, made from epoxide/glass laminates; p.v.c. and polyethylene have almost completely replaced rubber for cable insulation.

One of the largest fields for expansion in plastics has been found in the shipbuilding industry. Large ships are now using epoxide and epoxide/pitch paints for hull protection, and the whole spectrum of plastics is utilised for various internal fittings. A typical modern liner may have more than 1,000,000 sq. ft. (93,000 sq. metres) of decorative melamine-coated phenolic laminates. The boat-building industry has seen a marked switch over to reinforced plastics construction with built-in plastic foam buoyancy, particularly in the up to 16 ft. (5 metres) sizes, and perhaps as a result the use of small boats and fast runabouts is showing a rapid increase in the U.K.

The motor car industry continues to employ reinforced plastics for special sports models and for some lightweight family cars, but not yet on a really mass-produced basis. Of greater importance at present is the adoption of injection moulded components for interior fittings, and self-lubricating nylon bearings for suspension systems and similar parts. The now well-established p.v.c. upholstery for seats, sides and roof trims has been joined by thermo-formed panels of acrylonitrile butadiene styrene sheet, which occasionally is internally padded with polyurethane foam for crash protection. Adoption of safety belts made from woven "Terylene" or nylon is on the increase, but not yet universal as many think it should be.

The latest railway train coaches built for the nationalized British Railways also employs many plastics materials, and their interiors have been made far more attractive and easy to keep clean by use of decorative laminates, which are also becoming popular for underground stations and restaurants. The Moscow Trade Fair provided an opportunity to see applications of this kind.

Industrial Belting

Industries both above and below ground require conveyor belts. Few countries can equal Britain's experience on this matter, particularly with regard to fire resistant p.v.c. grades, and many miles of British belting reinforced with nylon or "Terylene" are in use in the U.S.S.R. The latest developments in belting were shown by firms including B.T.R. ("Green Bond"), Dunlop ("Star" range) Rubber Improvements Ltd., and Turner Brothers Asbestos, Ltd. Other end-products used in industry were on display, such as large plastic drums for bakers, polyethylene trays for food and butchery, and tanks for the dyeing trade (on the stand of Halex-division of British Xylonite, Ltd.).

How are such products made ? And what are the latest trends in equipment design ? In the thermosetting group, compression and transfer presses are decreasing their cycle times by improved mechanical design and by the addition of a pre-heater which warms the powder to just below its cure temperature before moulding. Another design of compression press employs multiple tooling on a rotary table to speed up production. Injection moulding is moving fast towards full automation for larger mouldings, as is already the case with small shots. A typical two ounce (56 grams) moulding may require a four-second cycle at present. Another recent development is the multi-station rotary table injection moulding machine.

Pre-plasticisation is desirable, particularly for the giant injection moulding machines such as Cravens HPM 300 ounce (8,500 grams) model (twin injection pre-plasticisation). These giants are being challenged by thermoforming machines depending on vacuum and air pressure which, it is claimed, can produce refrigerator linings with equal speed. Combined extruder/bottle blowing units now make three-gallon (13·6 litres) containers economically, and the blowing unit is capable of matching the extruder's maximum speed. Other extrusion units will make corrugated rigid p.v.c. roofing sheets, or, together with a calendar, p.v.c. floor tiles.

Technical Research Services

The last few years have seen the successful results of a number of large scale research programmes—some of them purely academic, and some with a specific end-product in view. All the major British raw material companies have extensive research laboratories, well stocked with the most up-to-date equipment, and the machinery makers co-operate in research. As a typical example, the I.C.I. technical service laboratories at Welwyn Garden City, Hertfordshire, England, are subdivided into sections, each run by a team specializing in one particular aspect of plastics material, its applications and processing. If we select polytetra-fluoroethylene as our material we find a complete unit with both academic and practical experts investigating processing problems of the polymer in each of its two basic forms—granular and dispersion.

While much work is devoted to improving existing methods of processing, considerable time is spent in looking into problems associated with some specific application on which the customer is seeking advice. A great deal of importance is attached to this side of the research programme by British companies. It ensures that not only the right type of polymer is selected for a difficult and perhaps costly job—precisely the correct grade is chosen and correctly applied. The result is a satisfied customer with a good opinion of the company, and also of the plastic industry as a whole. The same story applies to machinery suppliers, and the Dunlop advisory service is a good example of an organization covering a wide range of really large-scale problems.

Recent Discoveries

Research over the past few years has resulted in Professor Ziegler's low-pressure polymerization from which

came high-density polyethylene, and the vitally important process of catalytically-controlled stereospecific polymerization developed by Professor Natta, by which the side groups of the polymer chains are arranged in a non-random manner. Polypropylene, the stereoregular, highly crystalline polyolefine for which a spectacular future is confidently forecast, has rigidity, high melting point (in excess of 140° C.), remarkable chemical resistance and comparatively low cost.

There are many instances of two entirely different kinds of firm working together on a common project. The well-known Dorman Long steelworks has co-operated with G. A. Willis, paint manufacturers, to develop p.v.c. coated steel sheets for industrial cladding, also, at present purely experimentally, p.v.c. coated girders for bridge building. The long-term durability of the p.v.c. coating is much improved by the development of polymeric plasticisers—now used for many different applications of p.v.c. whether as emulsion paint material, or for industrial purposes. Such plasticisers do not migrate over long periods of time.

A milestone in the history of United Kingdom research was the setting up in January 1961 of the joint Rubber and Plastics Research Association of Great Britain, based on the Research Association of British Rubber Manufacturers. This illustrates the close co-operation between both sides of the high polymer industry, and will be of great mutual benefit, since much basic research covers ground common to both.

How does this situation tie with the needs of the U.S.S.R. ? Of the world's turnover in plastics for 1959 amounting to some 5,600,000 tons, Western countries accounted for 87 per cent., while the East is accredited with the remaining 13 per cent. However, this situation is only temporary.

Russia, with her enormous population, huge and rapidly-increasing industrial power and steady progress towards higher standards of living provides, at any rate in the immediate future, an almost unlimited market for both plastics products and the means to make them. The Soviet Journal *New Times* quotes the following figures for 1961 : Investments in the chemical industry up by 42 per cent., 40 per cent. in iron and steel, chemical industry's output up by 14·5 per cent. with plastics and resins up 32 per cent. and synthetic fibres up 20 per cent. Output of producer goods will rise by 9·5 per cent., and consumer goods by 6·9 per cent. In 1961 national income will be raised by 9 per cent., incomes in many categories will be up 5 per cent., retails sales up 5·8 per cent., with television sets increased by 14 per cent., radio sets by 13 per cent., and refrigerators and washing machines will be increased by a factor of 1·5. Between 9,000,000 and 10,000,000 people will move to new homes.

If all this comes about and future years follow similar lines, or perhaps increase the rate of progress, Russia is going to need an almost fantastic increase in consumption in order to continue the improvement in her standard of living. In this " high polymer age " one has only to look in the local retail shops to see the proportion of consumer goods manufactured from man-made materials. Industrial applications for plastics are becoming increasingly important, particularly in the field of protective coatings, chemical plant, transport, belting and hose, agriculture, building, electronics, to name just a few.

Russia seems to be well aware of this. The Russo-British Chamber of Commerce states : " According to Soviet Booklet No. 57 ' Statistics and Data Relating to the Seven-Year Plan ' ", the Soviet chemical industry will increase its output approximately three-fold in 1965 compared with 1958, and output of plastics and tars will increase more than seven-fold. Expenditure on chemical plant in 1965 will total 3,500,000,000 to 3,700,000,000 roubles (one new rouble equals one pound sterling), an increase of 220 to 240 per cent. on the 1958 figure. It appears from new data that in order to approach this the rate of increase of production must be rapidly stepped up. " The official statistics released in October 1960 state that gross output in the chemical and rubber industries in the first nine months of 1960 exceeded output in the corresponding period of 1959 by 11 per cent. Chemical plant was produced during the nine months to the value of 1,600,000,000 roubles, an increase of 38 per cent. on the corresponding period of 1959. The following specific increases in output were recorded :—

	Per cent.
Synthetic resins and plastics	12
Phenol-formaldehyde resins	16
Carbamide resins	53
Polystyrene and copolymers thereof ...	24
Polyethylene	54
Synthetic ethyl alcohol	15

" As to the Soviet requirement for chemical plant, their imports of this in 1959 totalled 461,000,000 roubles, as against 202,000,000 roubles in 1958 (from the U.K. 133,900,000 roubles and 25,100,000 roubles respectively (" old " roubles—11·2 to £1))." Some guide to Soviet requirements for their seven-year plan may be afforded by the " List of Equipment for possible import from the United Kingdom to the U.S.S.R. in 1960–4."

Five Ways to Help

How can the U.K. help with this programme ? Basically in five ways :

A. Provide the U.S.S.R. with the equipment which she needs to build up at the requisite ultra-high speed, her own production facilities to the levels specified in her present seven-year plan. Britain, with her history of engineering achievements, is in an ideal position to supply this type of heavy industrial machinery and chemical plant. The Rustyfa Consortium has already proved how successfully it can cope with large-scale projects as shown by the Dnepropetrovsk Tyre Factory, and there has been a rapid rise in such exports over the last two years.

B. Supply the U.S.S.R. with technical " know-how " on operating these plants. According to Dr. J. C. Mackay, chairman and managing director of Francis Shaw and Co. Ltd., U.K. exports to the U.S.S.R. in these same two classes amounted to £26,000 in 1957 ; £1,837,000 in 1958 ; and £6,545,000 in 1959.

C. Supply chemical intermediates and specialised raw materials.

As far as consumer goods are concerned, Britain can, as a fairly short-term policy provide

D. Intermediate fabricated products for Soviet industry, such as p.v.c. " Terylene " conveyor belts, p.v.c. polyethylene and polypropylene sheeting for fabrication in the U.S.S.R. into corrosion-resistant chemical plant.

E. Supply intermediate materials for the Russian consumer market. These could include the latest types of polystyrene sheeting for vacuum forming, polyethylene sheeting and layflat tubing for packaging, building, agriculture, and so on.

F. Supply finished consumer goods, to fill in the time " gap " before the U.S.S.R's. own plants are ready.

What of the period after 1965? By then the U.S.S.R. should be rivalling the U.S.A. as a producer of plastics materials and end-products, and no doubt will be offering them at high competitive prices.

Advances in

REFRIGERATOR CONSTRUCTION

as Related to High Impact Polystyrene Sheet, Thermoforming Machinery and

TECHNIQUES IN THE MODERN REFRIGERATOR

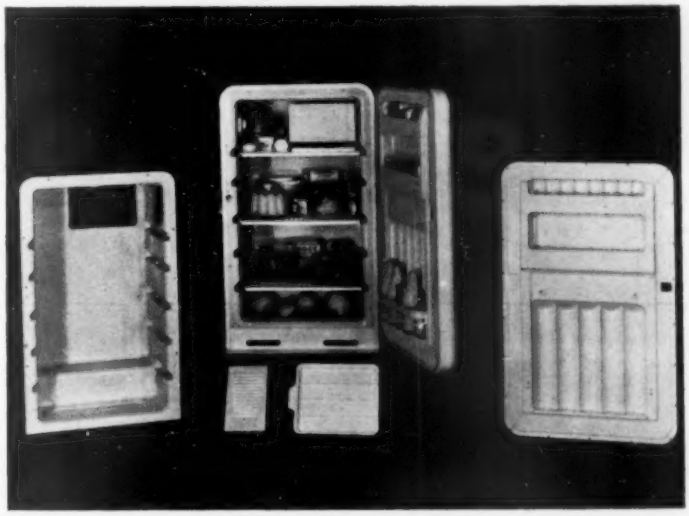
By J. P. GEOGHEGAN*

PLASTICS have become such an integral part of the modern refrigerator that advances made in the field of refrigeration manufacture must of a necessity cover, to a great extent, the entire processes from plastic raw material to finished cabinet.

Although we at Saro Products specialize in the extrusion of Saroy high impact polystyrene sheet, it has always been our concern to understand thoroughly and to be in a position to advise on all aspects appertaining to the use of thermoplastic sheet. This includes raw materials, physical properties of sheet to suit both thermoforming machines and design of components, information on machines, moulds and techniques and of course, essentially design.

It is difficult to establish, since the inception of thermoplastics for inner cabinet and door liners, at what particular period the main advances in refrigeration took place. The process has been gradual up to possibly last year, when the recession made the industry realize that competition would be particularly severe in 1961 and new designs, improved methods of manufacture, and more versatile approach to finish of plastic parts were inevitable.

As general extruders of polystyrene sheet we have a choice of raw materials, which in itself is important, since it permits us to extrude the right material for a particular application, and when supplying the refrigeration industry as a whole this can mean requirements in all shapes, sizes and thicknesses from the 1½ c.ft. model to the large Lec freezer/refrigerator of 18 c.ft.



4 c.ft. "Colonial" cabinet: inner liner, door liner, freezer door and drip tray thermoformed from Saroy sheet with glazed glossy/matt finish.

Until recently the industry has had to be content with just two finishes, namely matt/matt and laminated glossy/matt. The former was not considered suitable for inner cabinets and door liners, and the latter had severe limitations. It has always been considered bad practice to laminate a general purpose polystyrene film to a high impact polystyrene sheet, but if a gloss was required no alternative was to hand. Due to advances made in sheet extrusion, however, a third finish is now available, glazed glossy/matt. This is, without doubt, the ideal finish for refrigerator components since better formings are obtainable,

*Sales manager, Saro Products Ltd., Whippingham, Isle of Wight.

there is an absence of surface defects and greater resistance to cracking. The impact strength of the sheet is improved due to the elimination of film, thereby reducing costs during forming and assembly, and permitting the extruder to offer the sheet at a reduced price. It has also enabled inner cabinets of advanced design to be formed successfully in conjunction with the important advance made in thermoforming of trimless moulding. This latter process is very much tied up with gauge and size tolerances of sheet, thermoforming techniques using principally female moulds and technical " know how."

Company designers who are interested in this technique for their advanced models are advised to get in touch with our technical service department. A paper on this subject will be read later this year.

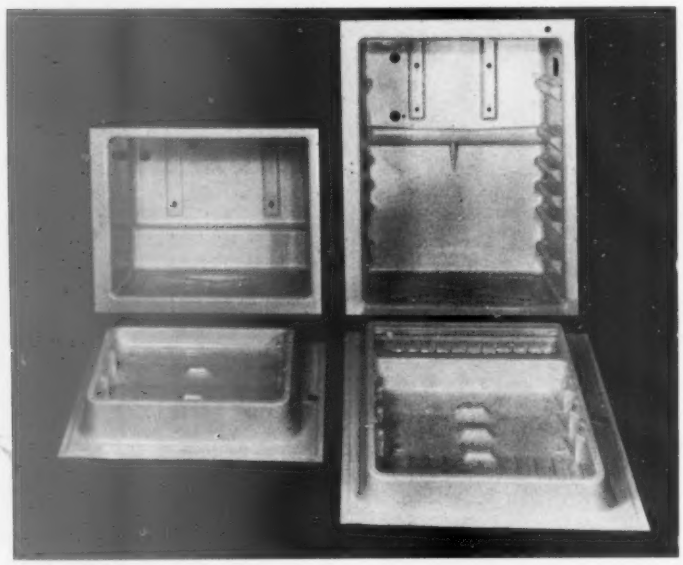
It is pointless to have the correct raw material and tailor-made extruded sheet if components cannot be satisfactorily formed and this leads to the very important factor of the thermoforming machine. Great strides have been made recently in producing machines capable of deep and intricate draws and only by working closely with the manufacturers can we hope to produce sheet to varying specifications. Considering the range of machines available flexibility is all important. There has been a distinctive trend in their design and advances have been rapid.

The art of thermoforming inner cabinet and door liners in England was pioneered by half a dozen fabricators under extreme difficulty. At that time few custom-made machines were available. The progressive expansion of refrigeration, however, gave the necessary impetus to both manufacturers at home and abroad and shortly a large range of machines became available. An additional spur was the knowledge that eventually the refrigerator manufacturers would do their own forming and their future programme was certainly impressive. Due to the foresight of overseas machine designers, however, the refrigerator manufacturers who have installed their own plant are now using foreign machines. This is also applicable to the fabricators who specialise in refrigeration inner cabinets and door liners. There are however, a few exceptions where fabricators have designed and built their own machines.

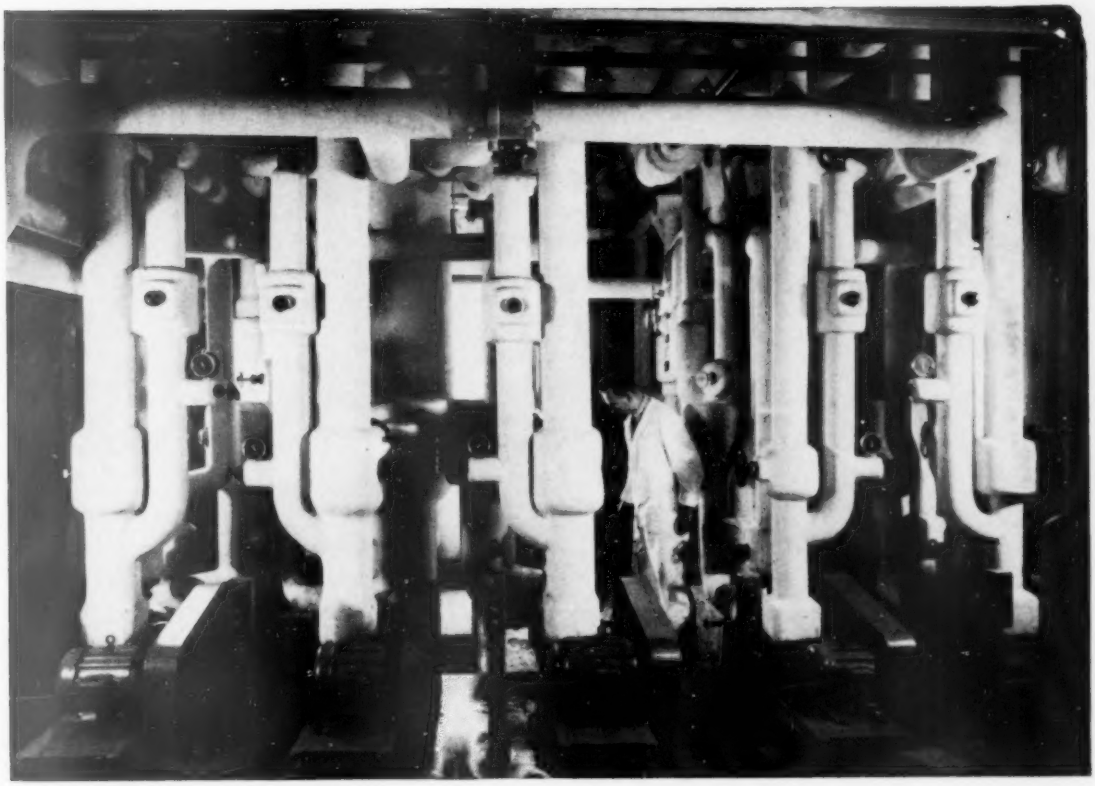
For the rate of production now required in the refr geration industry it is necessary to have machines fully automatic, except for loading and unloading. Sandwich heaters are es ential and although cho ce of male or female moulds depend on several factors it is preferable to use machines with a plug and tising table which is capable of producing all types of mouldings including those with returned edges. The advanced rotary machines have certain production advantages especially for door liners but their speed in forming inner cabinets is problematical when two up can be formed on conventional machines.

Coupled with the thermoforming machines and techniques are, of course, post-forming operations. Time has taught us to appreciate the importance of this stage of production. Up to date methods of trimming and machining are all contained in our Saroy manual and it is sufficient to say that many an excellent forming is still being ruined by lack of knowledge and post-forming carelessness.

It is easier and quicker to produce an advanced design for a refrigerator component than re-formulate raw material, extrude specialized sheet, invent new thermoforming machines and apply new techniques. It is, therefore, of the greatest importance that close co-operation exists between the designer and the companies who will be responsible for making his design a reality. If the designer is uncertain that it can be thermoformed in plastics, then he should consult the manufacturer.



18 c.ft. Lec freezer/refrigerator, inner liners thermoformed from Saroy sheet, glazed gloss/matt finish. The size of the larger inner liner is of special interest since it measures 35 in. by 44 in. to a depth of 21 in. and from .200 in. gauge sheet. The glazed glossy/matt finish made this possible.



ONAZOTE *Pipe Sections by the mile*

helps to make **Lyons Maid** *ice cream*

In this extremely advanced and well-equipped plant at Bridge Park, Greenford, Onazote pipe sections were exclusively used for insulating the thousands of feet of refrigeration pipe lines to the freezers and hardening tunnels, and also for insulating the ammonia vessels in the Engine Room. All the chilled water lines throughout the factory were also insulated with Onazote.

Onazote was chosen for its unrivalled insulation efficiency and low water vapour transmission. So valuable was the latter in this particular case that it was possible to put the ammonia lines into operation before the final vapour seal was applied.

THERMAL CONDUCTIVITY
0.20 B.Th.U/sq.ft. hour °F/inch at a mean temp. of 50°F.

WATER VAPOUR TRANSMISSION
at 100°F (38°C) and 1-90% relative humidity.
1.58 grains/sq. ft./24 hr./2 i.n.

installation throughout was by

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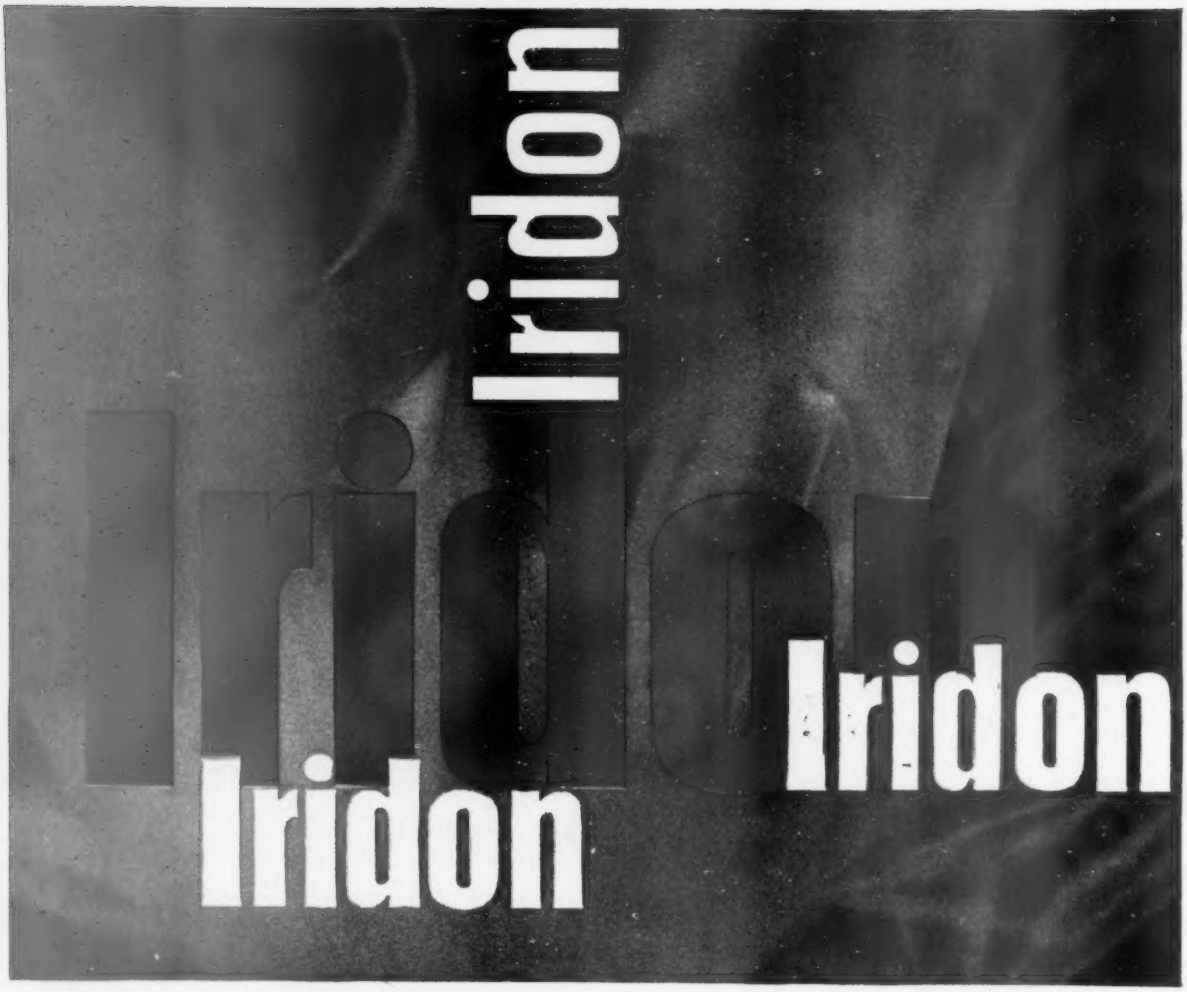
Mitcham Road, Croydon *Tel : THOrnton Heath 6022*

Subsidiary of Expanded Rubber Co Ltd A member company of The British Xylonite group



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PLASTICS
IN REFRIGERATION

By A. G. OWEN
Shell Chemical Company Limited

REFRIGERATION and plastics are both comparatively young industries and it is appropriate therefore that, in some spheres of activity, they should grow up together. Refrigeration plant helps to make feedstocks for the manufacture of bulk plastics; plastics, in turn, are used ever increasingly in the manufacture of domestic refrigerators, and, in their expanded form, insulate the refrigeration plants which contribute to their very existence.

A great deal of published literature and statistics is available on the many applications for plastics in refrigeration and the phrase, "a growing industry" has been penned to death with facile optimism, but so important is this sphere to the plastics industry that a certain amount of reiteration is perhaps justified. For instance, in 1960 27 per cent. of the total U.K. polystyrene production (excluding expanded polystyrene) was used in refrigeration, representing over 10,000 tons of material. To this figure must be added approximately 1,300 tons of expanded polystyrene for thermal insulation of cold stores, pipework, vessels, and ancillary plant. "There are lies," said Disraeli, "there are damned lies, and there are statistics" and 1,300 tons of expanded polystyrene may not sound very impressive but, converted into insulation board it represents a figure of 31,200,000 board feet.

Toughened polystyrene is used for refrigerator liners both for the cabinet and the door, for ice box trays, freezer doors, salad "crispers" and tray shelves. The high surface gloss, scratch resistance, and colour range possibilities (which are virtually limitless) of this modified form of polystyrene render it the most widely used plastic for these applications. Straight polystyrene of crystal clarity is used for the wide variety of food containers which are commercially available and which are essential to counteract the dehydrating effect of low temperatures on most foods. This problem of humidity which exercises the ingenuity of cold storage designers is no less real to the housewife, even though she has far fewer cubic feet of space to worry about.

Should polyurethane foams blown with fluoro-

Removing sheets of "Styrocell" expanded polystyrene board from the cutting machine at Shell Chemical Company's works at Carrington.

Shell Chemical Company's "Styrocell" is an excellent insulator and methods have been developed to ensure that this material, which is widely used for insulation of refrigerator chambers and home-building, is non-inflammable. This material was, therefore, used by Messrs. D. J. Paddy & Sons to convert rooms of an existing building at Red Lion Three Cranes Wharf in the Rotherhithe dockland area, into a cold store. The walls and ceiling were insulated with 3-in. thick blocks of polystyrene. The walls were then coated with two applications of cement and sand render. Three-inch thick blocks of polystyrene were also used on the floor. This was then coated with a 2-in. layer of granilitic flooring. Two workmen are here seen applying the final application of cement and sand render to the "Styrocell" covered walls.

carbons become popular as insulation for the domestic cabinet then a terpolymer of acrylonitrile butadiene styrene will probably replace toughened polystyrene because of the softening effect of fluorocarbons on polystyrene. Fluorocarbon gases having a lower thermal conductivity than air give foams with very good insulation properties making it possible to use lesser thicknesses of insulation thus enabling the cubic capacity of a refrigerator to be increased without increasing the external dimensions.

Rigid polyurethane foams have been the subject of considerable recent research and have already made some impact on the thermal insulation trade because of their ability to be foamed "in place" to give a closed cell structure of low water absorption. Although initially more expensive than expanded polystyrene they can show an over-all saving on awkwardly placed installations where, instead of the traditional method of cutting and routing the insulation boards to fit, the installation is boxed in and the polyurethane is foamed within the cavity so formed.

Polyurethane foams have high adhesive strength to most surfaces, an important property when producing sandwich panels for doors, partitions, ships'

The complex plant of Shell Chemical Company is situated on a site at Carrington, near Manchester. Here are produced aromatic hydrocarbon liquids and gases containing a large proportion of olefins, these being obtained simultaneously from a light petroleum distillate. From this single feedstock are derived a wide range of chemicals for industry. Here an operator is shown at the controls of the polystyrene extrusion unit.

He's locked out the heat!

He walked half a mile along the beach, in the hot sun, so that the rest of the family could have ice cream. And that takes a chap time. Both chaps and ice cream tend to melt a bit on hot days. But he took the precaution of putting his purchase in a case made from Styrocell, which is just about the best insulating material there is. Like all the rest of the clever plastics made by Shell, Styrocell has unique properties.

To begin with, it's the lightest form of plastic known to man. You can saw it, shape it, nail it if you like. Styrocell is an expanded plastic and consists of thousands of enclosed pockets of still air, hence its excellent insulation properties. It is absolutely ideal for moulding applications.

STYROCELL

Shell Chemicals SHELL

Ask Shell Chemical Company Limited,
Plastics & Rubbers Division, 170 Piccadilly, London, W.1.

SHELL and STYROCELL are registered trade marks.

S.5

Refrigerator liners of 5 c.ft. capacity are being produced on this giant injection-moulding machine at the Ekco Plastics factory, Southend-on-Sea, Essex.

hatches, and other applications where lightweight and rigidity are required. The technique of sandwich construction is, briefly, the laminating of materials with high rigidity but little flexural strength such as foamed plastics or honeycomb structures, with materials having high tensile strength but little rigidity such as aluminium or plywood. The resulting sandwiches are strong, light and have a high insulation value.

Although by some definitions expanded ebonite is not a plastic, mention should be made of its contribution over many years to the thermal insulation trade. It was one of the earliest synthetic insulation materials to be commercially available; it is durable and has good angling characteristics.

To return from foams back to solid plastics, a p.v.c. copolymer is now being used by one U.K. manufacturer as a refrigerator liner. It has a higher impact strength than toughened polystyrene, better chemical resistance but, at the moment the required grade of p.v.c. sheet is rather expensive as it has to be imported.

P.v.c. is also used as a "dip coating" for wire shelves; rigid sheet is vacuum formed for food containers and packages; door gaskets are extruded from plasticized p.v.c.

Polyethylene, by virtue of its toughness and pliability has several applications in domestic refrigerator construction as protective kick-plates, ice box separators, ice trays, dip coating on shelves, food containers and, one of the largest applications, as packaging film for frozen produce. One million bags of low density polyethylene are used each week for the packaging of broiler fowls alone, representing an annual usage of 500 tons.

Where poultry is stored at deep freeze temperatures a polyvinylidene chloride film is preferred. This is heat shrunk around the bird to eliminate pockets of air which could cause freezer burn. Also, an important characteristic of polyvinylidene chloride is its very high resistance to the passage of water vapour, in which respect it is very much more efficient than low density polyethylene, hence weight losses by desiccation are considerably reduced.

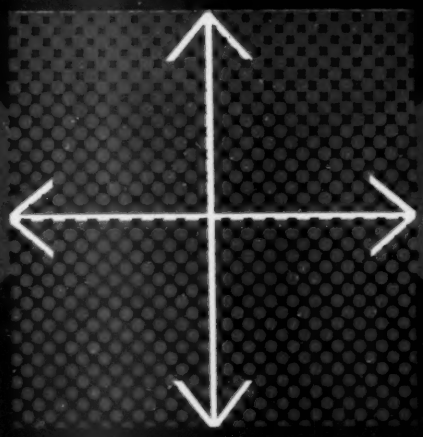
Although it is still a comparatively new material to the U.K. market, polypropylene would seem to offer many advantages on certain applications by virtue of its toughness, rigidity, attractive surface appearance and surface hardness. Biaxially-oriented polypropylene film has a remarkable clarity and, in the packaging of frozen foods, it would appear to have a considerable future.

Among the wide miscellany of plastics in refrigeration, mention must be made of the growing use of nylon for handsets, inserts and door catches, polymethyl methacrylate for extra-strong food containers, cellulose acetate for decorative mouldings and escutcheons, and the very wide decorative range of melamine/phenolic laminates for work tray tops. In expanded or foamed plastics, as well as polystyrene and polyurethane, p.v.c., polyethylene, and urea formaldehyde are also used for thermal insulation, while expanded elastomers are extruded or moulded to form gaskets for freezer doors, plug hatches and other applications where a water vapour seal is required. The term "refrigeration" by dictionary definition is the technique of making cool, or cold, or freezing, but to the general refrigeration trade the connotations of this word reach far beyond into the fields of engineering, building, cabinet making, woodworking, mass production techniques, as well as the many calls for "one off" to a given design, and indeed, embraces a whole variety of trades and industries. Plastics—"a group of synthetic resinous or other substances that can be moulded into any form"—embraces an even wider range of activities.

It is hardly surprising then that plastics and refrigeration should so often meet in harmony.

MILLIONS

OF AIR POCKETS



PER CUBIC INCH

Or why foamed polystyrene — made with Monsanto Montopore — proves so effective as an insulating material

Foamed polystyrene can be moulded into any shape, any size, any thickness. The mouldings are tough and rigid, feather-light and non-toxic, odourless and rot-proof, dimensionally stable and unaffected by vibration. And they do a marvellous millions-of-air-pockets-per-cubic-inch insulating job.

For more information, and the name and address of your nearest supplier, write to Monsanto—the makers of Montopore, the raw material for foamed polystyrene. *Montopore is a Registered Trade Mark*

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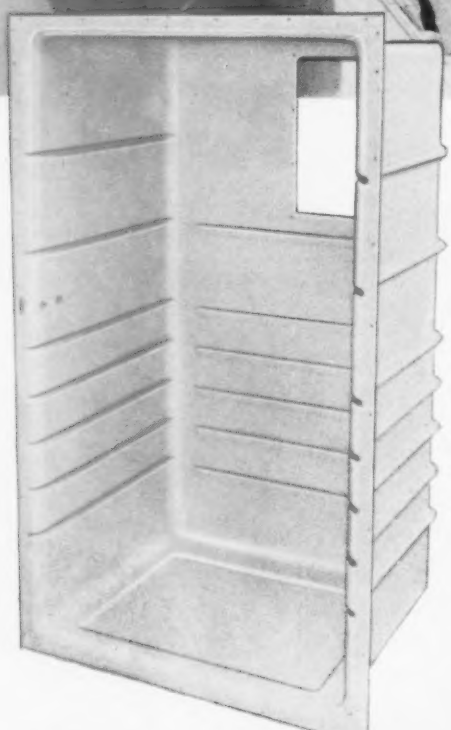

These refrigerator liners are moulded from 'Flovic' I.C.I. vinyl copolymer sheet by Clearex Products Ltd., Heather Park Drive, Stonebridge Park, Wembley, Middx. They are for the AF-130 commercial refrigerator made by Aero Pipe & Glass Co. Ltd., High St., Yiewsley, Middx. for Frigidaire, Stag Lane, Kingsbury, London N.W.9.

Vacuum-formed 'Flovic' makes the ideal lining for this Frigidaire* commercial refrigerator

*Regd. Trade Mark

Because tough, high-gloss 'Flovic' vinyl copolymer sheet shows little tendency to necking or thickness variation, even when considerable stretching is involved, it can be vacuum-formed into intricate, deep-drawn shapes. 'Flovic' is also easy to blank and drill.

High quality, excellent definition and good impact and tensile strengths are characteristics of mouldings produced from 'Flovic'. The complete absence in 'Flovic' of heavy metals and any harmful constituent, makes this I.C.I. material ideal for the liners, door panels and other fittings in refrigerators.

'FLOVIC'

'Flovic' is the registered trade mark for the vinyl copolymer sheet and foil manufactured by I.C.I.

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SOME OF THE EXHIBITS DESCRIBED

MONSANTO

A FLORAL garden of plastic shapes will be the immediately noticeable feature of **Monsanto's** stand. Accompanying it will be a down-to-earth display of products made from plastics supplied by this firm. These will underline the practical application of Monsanto polyethylene and Lustrex polystyrene in the field of domestic appliances and household wares ; of Montopore foamable polystyrene (for heat insulation) and polyethylene (for pipes and electrical insulation) in the building trade ; and of Lustrex polystyrene, polyethylene, Montopore foamable polystyrene and Polyflex biaxially-oriented polystyrene film and sheet in packaging.

The display will include products of leading British manufacturers made from Monsanto raw materials ; among them will be examples of the extensive use of plastics by the radio and refrigerator industries.

In the injection moulding field polyethylene will be shown, together with the following grades of Lustrex polystyrene GP, T3, T6, T7, T11, UVL, low static ; and its high-softening grades : GP/HS, T3/HS and T7/HS.

Lustrex T6 is a grade especially produced for the extrusion of sheet for vacuum forming. Polyethylene and polyflex biaxially-oriented polystyrene will represent plastics for blow-moulding and vacuum-forming respectively. Polyflex, which is of particular value in packaging, is also suitable for pressure forming and cold folding processes.

* * *

SHELL

Shell Chemical Co. Ltd., and **Shell International Chemical Co. Ltd.**, are exhibiting a comprehensive range of plastics raw materials. Among these are " Carlona " P polypropylenes ; " Carlona " high-density polyethylenes ; " Carlona " low-density polyethylenes—introduced to the Shell range since the last exhibition ; " Carlona " PVC ; "Carinex" polystyrenes and styrene/acrylonitrile copolymers ; styrene monomer ; raw materials for the manufacture of polyurethane foams ; " Epikote " epoxy resins.

Applications on view illustrate the many fields in which Shell plastics are being used and articles will be grouped according to their end-use industry. There will be sections devoted to displaying applications in many outlets, including building, packaging, domestic, electrical appliances, engineering and holloware.

* * *

ECKO

Thermosetting and thermoplastics mouldings and vacuum-formed components, as used in a wide variety of industries and in the home, are displayed on the stand of **Ekco Plastics Ltd.** One of the largest users of Ekco mouldings is the refrigeration industry and the representative selection of components displayed includes a range of injection-moulded liners up to 5 c.ft. capacity—the largest refrigerator liner yet produced by this process in the U.K. Other refrigerator components on view include vacuum-formed door liners and many smaller parts produced by the injection moulding system and illustrating the extensive range of finishing processes available as part of the Ekco Plastics service to industry.

Mouldings for many other industries and for the home are also prominently featured in the display.

* * *

WHIFFENS

New developments in the treatment and applications of plastics will be highlighted on the stand of **Whiffen & Sons Ltd.,** chemical manufacturers of Loughborough.

Ralsin, the special nylon for which Whiffens are sole agents in the United Kingdom, was exhibited on the stand in a range of products to illustrate its versatility. As a coating material to resist abrasion and corrosion, it is shown as a protection for metal-framed chairs and deckfittings and as a lining for valves. On both interior and exterior metalwork, Ralsin coatings withstand temperatures ranging from –40° to +130° C. The exhibits show how it provides a high-quality decorative finish together with resistance to corrosion.

Sections of strong, lightweight and flexible Ralsin pipe will be shown. These exhibits which have been extruded to extremely close tolerances, are resistant to all chemicals in common use and withstand both steam and ice temperatures. High-pressure hose of the type shown on the stand is replacing metal tubing for brake hose on many modern cars. Tubing for fuel lines will be exhibited. In addition, some of the exhibits are products moulded from Ralsin. The precision-made gears, door-catches, casings and sealing rings shown on the stand have a lower water absorption than components made of any other nylon. They have a high resistance to abrasion and chemicals and are practically unbreakable.

A prominent display will also be made of garments and upholstery cloth made from PVC which has been expanded by Whiffens' Genitron AC. To illustrate this new development in blown plastics the company will exhibit a selection of the self-coloured leathercloths now being introduced on to the British market. Like leather these materials combine softness with strength. Other exhibits made with or using expanded PVC are handbags and furniture.

* * *

GEORGE GOODMAN

George Goodman Ltd. (the plastics division of the G.K.N. Group) are showing examples of their GG Mini-Moulding production technique. This employs single impression tools working at high speed, thus lending itself to the production of intricate engineering components in thermoplastic materials, with special emphasis on nylon.

A feature of this year's display is the Insulgrip Fastener. This offers a tough and virtually indestructible form of anchorage and is of particular value where fastening access is limited to one side of the assembly. Also shewn are nylon coil bobbins for miniature transformer work, nylon chain and numerous examples of precision plastic components, such as gears, bearings, etc. Samples are also displayed of the GG Mini-Cast technique, which specialises in similar components diecast in Mazak zinc alloy.

Housewives welcome cool clean

Ten years ago, Styron Polystyrene started a quiet revolution in refrigerator manufacture. Today it continues – bringing a clean cut elegance to design, reducing refrigerator bulk, cutting production costs by one-piece forming. Complex vacuum-moulded inners and door liners, as well as moulded strips, trims and containers for food – all in Styron – are now a feature of many modern refrigerators. This is an achievement to be proud of.
For more information about Styron Polystyrene, please write for Booklet No. 211

Styron is a trade mark of the
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BRP

SALES AND TECHNICAL SERVICE DEVONSHIRE HOUSE PICCADILLY LONDON W1 HYDE PARK 0151

Distillers Plastics Serve Everyman

G.K.N.

A new product on show at the **Guest Keen & Nettlefolds (Midlands) Ltd. Screw Division Stand** is the plastidome mirror screws available in seven colours and wrapped in plastic bags or cartons containing one gross. Nylon screws as well as self-tapping screws once again feature largely and N.P.K. socket screw products used in so many presses will be on show.

* * *

BX

In addition to their wide range of thermoplastic materials, **BX Plastics** are showing a new polythene film designated 503 Cast Bexthene Film. This has been produced essentially for over-wrapping applications and for soft goods packaging and it combines outstanding optical properties with a soft, pleasant feel. Other applications include the packaging of bread, meat and frozen foods. The film is treated on one side for permanent ink adhesion and can therefore be printed in all colours. 503 Bexthene has an exceptionally high yield and being anti-static and anti-blocking, overcomes the problems of dust pick-up and therefore makes for trouble-free packaging for automatic processes.

Also on show are the Cobex rigid vinyl sheet, Velbex flexible vinyl, Bextrene polystyrene moulding powder and Bextrene sheet. The latter polystyrene materials are well known in refrigeration circles since they are used for such items as food containers and door liners.

* * *

M. & B.

A new water soluble polyvinyl alcohol film, "Pevalon" H.15 PM., is being tried as a new method of packing household detergents; water soluble pva film has many potential uses. In industry, water soluble pva film, with its inertness to many chemical compounds and solvents can be used for packing pre-weighed quantities of toxic chemicals, dyes and printing inks, which are difficult or unpleasant to handle. Many other industrial and domestic products are dissolved in water before use, for example, photographic chemicals, agricultural and horticultural sprays, fire extinguisher chemicals and disinfectants and deodorants for water systems. The marketing of pre-weighed units in water soluble film is a logical step forward in the development of packaging.

"Pevalon" pva films are produced in gauges down to 1½ thou., with a range of solubilities to suit the product being packed. The cost of these films is directly proportional to thickness so that the introduction of this gauge in "Pevalon" H.15 PM has halved the overall cost compared with 3 thou. and has opened up a whole new field of packaging for the consumer market.

Another important feature of "Pevalon" H.15 PM is its matt finish. The matt face, when used as the inner surface of a sachet, overcomes the problem of blocking so that automatic packaging with water soluble pva films is now a practical proposition.

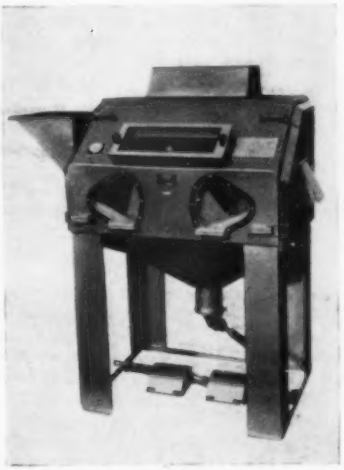
"Chromalon" metallized polyvinyl chloride is the latest addition to M. & B. Plastics' range of metallized films for decorative and technical purposes. As the material is non-inflammable, the thinner substances will be of particular interest for decorative applications, while the thicker gauges will find use in the production of labels and vacuum formed packages and display units.

Other products being exhibited on this stand are **May & Baker Ltd.'s** plastics products and specialized chemicals for the plastic industry; **Soc. des Usines Chimiques Rhone-Poulenc's** plastics products; and **Compagnie Industrielle plastiques Semi-Ouvre's** increasing range of semi-finished plastics products. The latest additions to these companies' ranges include "Acelon" coated fabrics; "Rholene" high density polyethylene sheet, plate and film; "Soreflon" p.t.f.e. moulding powders and dispersions; and "Ciponyl" polyamide films.

* * *

GUYSON

Guyson Industrial Equipment Ltd. are displaying a working example of the model T/40 Guyrota "automatic blast cleaning machine" which is designed to tumble large quantities of small mouldings under the abrasive stream to rapidly remove all trace of "flash." Although the model T/40 Guyrota has been on the market for almost a year now, this is the first time it has been featured at the exhibition. The company invites visitors to bring along small batches of mouldings for treatment in the demonstration machines which include the model SBP/40 plastic deflashing machine.



Model SBP/40 Guyson plastic deflashing machine.

This machine is particularly useful for deflashing intricate mouldings requiring individual treatment. Designed for day-long operation it is provided with a special hopper to enable the operator to sit comfortably at the machine.

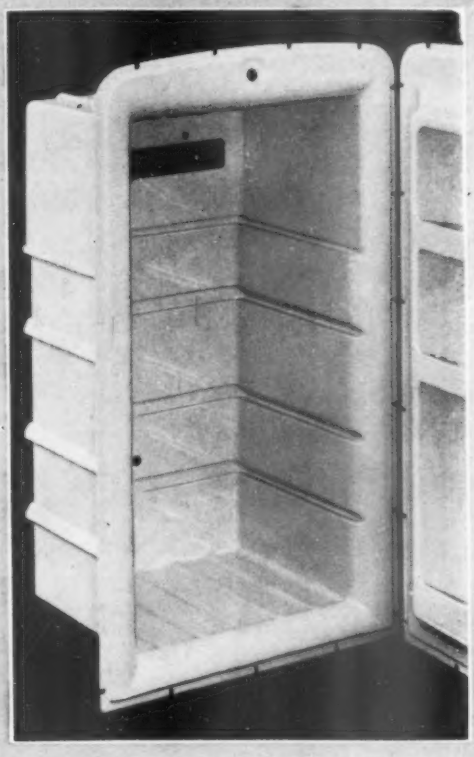
"M.R."

"MODERN REFRIGERATION" will be displayed at the Plastics Exhibition on the Stand (BB 537) of R.P.L.'s parent company, Maclaren & Sons Ltd.

ETHYLENE DICHLORIDE

British Hydrocarbon Chemicals Limited's large tonnage plant at Grangemouth for the manufacture of ethylene dichloride (1 : 2 dichlorethane) will come on stream in July/August, 1961. The bulk of the production of ethylene dichloride will be shipped to the Distillers Plastics Group factory at Barry, South Wales, where it will be used for the manufacture of vinyl chloride and hence PVC.

Ethylene dichloride has many solvent applications in paint remover formulations, rubber cements, extraction of vegetable oils and metal degreasing. As a chemical intermediate, it can be used for the preparation of ethylene diamine and succinonitrile. In admixture with carbon tetrachloride it is used for grain fumigation.



The complete inner and door lining for The Astral refrigerator are vacuum formed in Bextrene toughened polystyrene sheet by Thermoplastics Ltd., Dunstable.

Bextrene for toughness

Bextrene (toughened polystyrene) extruded sheet is the cheapest rigid plastic sheet with the highest yield. Its easy formability makes it particularly suitable for vacuum-forming. Uses include refrigerator liners, radio and TV components, display and semi-rigid packaging materials. Supplied in rolls, sheets and panels from 0.010 in. to 0.180 in. thick and up to 48 in. wide. Standard stock sheets 56 in. × 24 in.

BX PLASTICS LIMITED
The British Xylonite Group
BRANTHAM,
MANNINGTREE,
ESSEX
Tel: Manningtree 401

TA 5336

. . . NEWS from the World of PLASTICS

PLASTICS IN PACKAGING

The British Plastics Federation announces the formation of a new group to deal with packaging which it is estimated uses 40,000 tons of plastics per year at a value of about £200 per ton. Thirty-eight major member-companies of the federation have expressed interest in the packaging group. A group management committee has been formed to include packaging manufacturers, material suppliers and engineers, and Mr. D. J. Liston (Metal Box Co.) has been elected chairman. A technical committee is to be formed under the chairmanship of Mr. P. P. Hopf (Boake, Roberts). Among the first matters to be considered by the Packaging Group will be standards, statistics, transportation, matters of public health and consumer protection.

HEDON PLANT EXTENDED

Hedon Chemicals have recently completed substantial extensions to their vinyl acetate plant at Salt End near Hull. The plant is situated on the 100 acre site owned by The Distillers Co. Ltd., Chemical Division. Hedon Chemicals is jointly owned by D.C.L. and Shawinigan Chemicals Ltd. of Canada. The vinyl acetate plant was initially commissioned in September, 1956, and the recent expansion will increase the original productive capacity by approximately 60 per cent.

The demand for vinyl acetate monomer has been growing steadily in all parts of the world. Among the numerous current uses of vinyl acetate, the most important ones are for emulson paints, adhesives, and plastic compositions such as floor tiles and gramophone records. In the latter application, copolymers with vinyl chloride are used and such copolymers are also used in the surface coating industry as solution lacquers with a very high degree of chemical resistance and excellent colour. Other fields in which vinyl acetate finds application include cements and elastomers. It is also the raw material for the manufacture of polyvinyl alcohol.

Mr. J. Y. Woods has recently joined the Building Materials Division of **Expanded Plastics Ltd.,** Croydon, members of the E.R.C. group manufacturers of polyzote insulation and other expanded materials for the building industry. For several years Mr. Woods has been promoting the use of expanded polystyrene in the building industry and has been closely associated with the development of this material in its use as a "dry screed" for the thermal insulation of concrete roofs.

TWO NEW APPOINTMENTS AT POLYPENCO

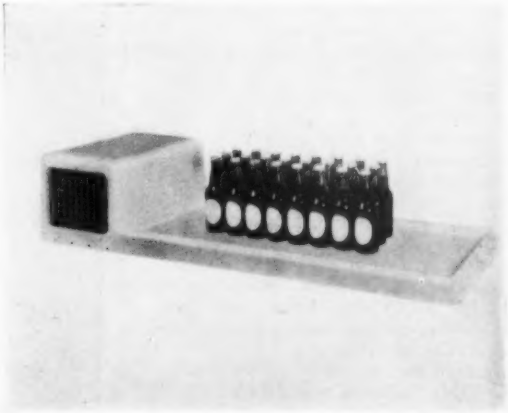
Polypenco Limited, manufacturers in Welwyn Garden City of a wide range of extruded shapes in PTFE and nylon and also custom-designed pressed parts, announce two new executive sales appointments. Mr. P. D. Mitchell, formerly assistant sales manager, becomes technical sales manager and responsible for technical sales development, new product research and general sales promotion. A graduate of the Institution of Production Engineers, Mr. Mitchell was formerly a planning engineer with The de Havilland Aircraft Co. Ltd. He joined Polypenco Ltd. in 1958. Mr. E. Smedley, appointed sales office manager, has been with the company since 1959. His new responsibilities include both home and export sales enquiries.

GLASS FIBRE BOTTLE COOLER

J. Samuel White & Co. Ltd. announce that techniques developed in their boatyards over the past five years have made possible the production of a new range of refrigerated display counters and bottle cooling shelves. The main advantage claimed in this method of construction using fibre glass reinforced plastic is that the upper surface which comes into contact with the refrigerated product is of one piece, all joints and corners being eliminated to ensure ease of cleaning. The whole surface is finished in smooth plastic which can be easily cleaned by wiping with a damp cloth. The evaporator plate is built into the counter during manufacture and consequently is fully sealed against the atmosphere, thus eliminating any danger of external corrosion. Fibre glass insulation is incorporated in the slab, the final seal being made during manufacture so that the ingress of moisture is completely eliminated.

PLASTICS IN ROAD TRANSPORT

Built by Mann Egerton & Co. Ltd., a new refrigerated vehicle is one of four recently supplied to T. Wall & Sons (Ice Cream) Ltd. Designed by Walls specifically for the bulk transport of canned ice cream, the vehicle comprises an insulated body fitted to an A.E.C. Mammoth chassis/cab. The body, which is of double framed all-alloy construction, is insulated with 5 in. of polyzote. The interior is divided into three compartments by two baffle doors and has a capacity of 1,000 c.ft. with payload of 15 tons.



White's bottle cooler.

PLASTIC COATINGS DEVELOPMENTS

A THREE-PHASE comprehensive service to the British plastic coating industry has been developed by the London firm of **Dohm Ltd.** It comprises the supply of raw materials, low-cost plant to apply them, and a technical advisory service in "know-how" which includes the training of users' key operatives. One import of this is that, with a minimum of capital expenditure, manufacturers could process their products from start to finish within their own factories.

On the raw materials side, Mr. Rolf Dohm, director of the firm's plastics division, announces the production of the first British nylon powder suitable for dip- and spray-coating. It is a nylon type six powder with excellent chemical, electrical and abrasion resistance properties, high impact strength and wide temperature range. Previously the only nylon powder available to the British industry has been a type 11, which is imported from France. Light industry producing finished consumer durables, electrical goods, metal windows, etc., are more likely to employ the dip coating process.

Dohmpowder Nylon has been developed for both dip coating and flame spraying, giving a high impact resistant coating. Its corrosion resistance is very high except against mineral acids, and it has an electrical resistance of 600v. per 0·001 in. coat. Limitations of deposit by dip coating are from 0·010 in. to 0·025 in., and by flame spraying from 0·010 in. to any economical thickness. The temperature range is from –40° to +140° C. and it has a melting point of 190° C. approximately.

Dohmpowder Polyethylene has also been developed for both dipping and spraying, giving a colourful, corrosive- and chemical-resistant coating for metal and glass (for instance, bottles which are to contain pressurised fluids). Electrical resistance is from 175v. to 250v. per 0·001 in. thickness of deposit. Temperature range is from –30° to +100° C. and the limitations of deposit range from 0·020 in. to 0·070 in. by dip coating, and from 0·020 in. to any economical thickness by spraying.

For the impregnation of textiles with polythene two processes are being developed. One is a continuous surface coating in which the dry powder is distributed finely across the moving web of cloth and fused into a pinhole-free coating by the application of heat at a temperature between 120° to 130° C., according to the melt index of the powder and the speed of production. (Infrared can accomplish the fusion process without injury to the substrate when the material is too sensitive to normal baking methods). A variation of this is a partial surface coating treatment when the cloth is required for heat sealing applications such as linings, and furnishing quiltings in which, for instance, felt is sandwiched between decorative fabrics. In this case, only a very early stage of melting is reached, so that discontinuous globules are left on the material and allow it to be bonded to another fabric by ironing.

The second process for powdered polyethylene which is also showing great promise is its use as a binder for non-woven fabrics such as paddings, where it has great advantages over paste. It is expected that the rainwear, protective clothing and tenting markets will be affected by these developments. Other probable applications are in the carpeting field, the packaging of corrosive liquids and water sensitive materials, and for packaging foodstuffs (polyethylene being non-toxic).

BOOK REVIEW

"British Plastics Year Book 1961." Published for "British Plastics" by Iliffe Books Ltd. Size 9¼ in. by 6¼ in. 712 pages. Price 45s. net. (by post 47s.).

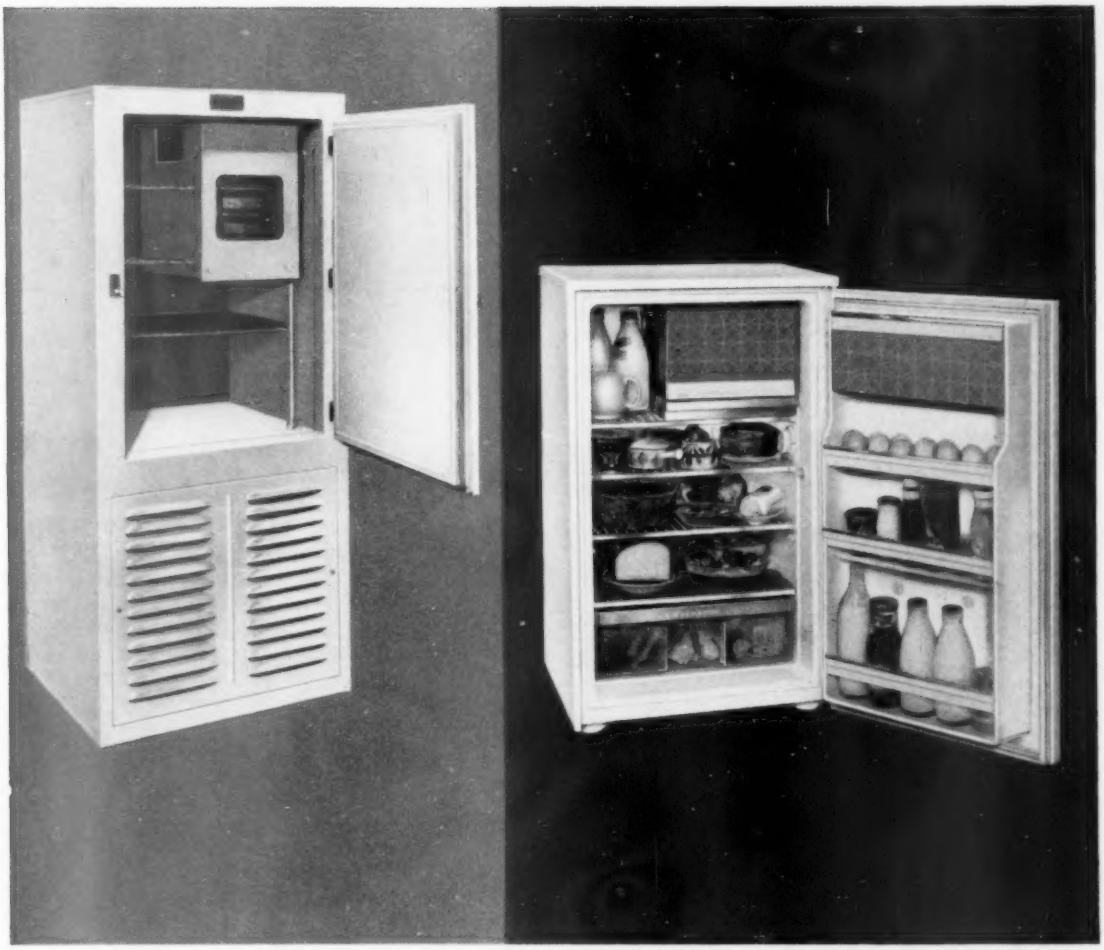
The **British Plastics Year Book** is divided into 10 sections. Three are devoted to classified lists of manufacturers and suppliers of materials, finished products and equipment; while a fourth section, new in this edition, lists companies giving basic services from moulding and extruding to welding and metallizing. The world's largest list of trade and proprietary names connected with the industry is given in another section: each trade name is followed by a definition of the product and the manufacturer concerned.

The names and addresses section contains over 7,000 firms associated with plastics, those in the United Kingdom and overseas being listed separately; no less than 4,000 firms overseas are now included. The Who's Who section gives the names and positions of prominent people actively engaged in the industry in the United Kingdom. These lists have been thoroughly revised and extended. The set of tables giving comparative properties of plastics materials has also been revised and brought up to date, and in the same section are included a revised glossary of technical terms, lists of new companies registered during 1960, and specifications relating to plastics.

This comprehensive classified guide to products and manufacturers in the United Kingdom plastics industry is invaluable to all connected with plastics and to manufacturers and users of machinery and equipment.

TOUGH FOAMED MATERIAL

Cross-section of Armstrong Expandofoam after it has been foamed and allowed to solidify. The material is composed of uniform, small, closed cells and has unusual toughness and strength in addition to high thermal efficiency and moisture and vapour resistance.



Reproduced by courtesy of Frigidaire Division of General Motors Ltd.

You learn a lot in 29 years...

✳ Only practical experience could have made possible the great improvements between the refrigerator of 1932 and 1961.

✳ For much of that time Ekco Plastics have been closely associated with the refrigeration industry, contributing to many advances in construction and design.

✳ This, undoubtedly, is a major reason why Ekco Plastics can, and do, solve so many problems for so many refrigerator manufacturers—in a sound and practical way.

We too have learned a lot in 29 years. Our experienced designers and engineers will willingly discuss your plastics problems—entirely without obligation.

EKCO PLASTICS LTD · SOUTHEND-ON-SEA · ESSEX

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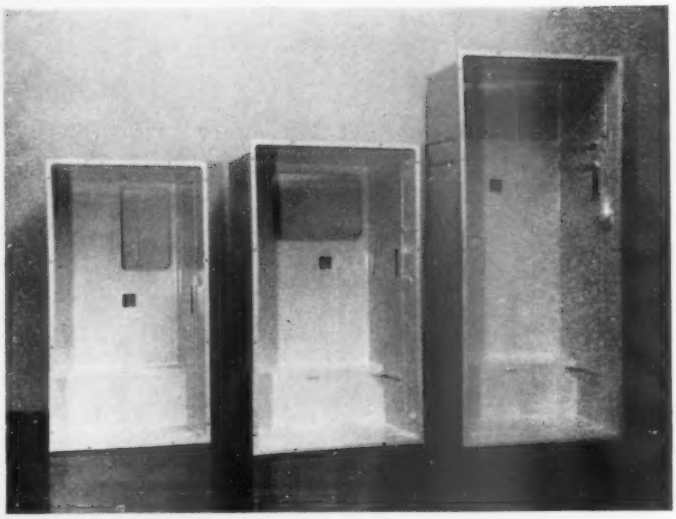
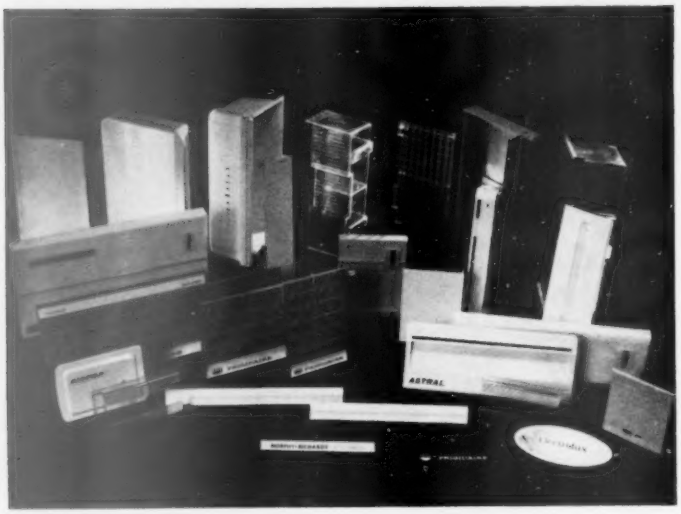
EKCO PLASTICS

for the Refrigeration Industry

Refrigerator Applications of Plastics

Recent examples from Ekco Plastics Ltd.





Above: These refrigerator liners are injection-moulded for three current Frigidaire models. The 5 c.ft. capacity model on the extreme right is the largest liner yet produced by the injection-moulding process in the U.K.

Left: All these components are injection moulded. Decorative effects are obtained either by spray painting behind transparent mouldings, hot stamping colour on the outer surfaces, or by a combination of both techniques.

Quiz for Servicemen—4

16. How many types of heat transference are there? State what they are and where used in a refrigeration system.
17. What is a B.t.u.?
18. Define Specific Heat.
19. An ideal refrigerant should possess at least two important qualities. What are they and why are they of importance?
20. Define Saturation Point.
21. The ability to alter the boiling point, i.e., temperature of a refrigerant is of importance in refrigeration. How is this achieved?
22. What is meant by Adiabatic Compression?
23. What types of metal should not be used in a NH_3 system?
24. What is the Latent Heat of Fusion?
25. Why is it important that a condenser be kept in a clean condition?

Answers to the above should be concise; indeed, each question can be answered in under 100 words and, in most cases, in under 75 words.

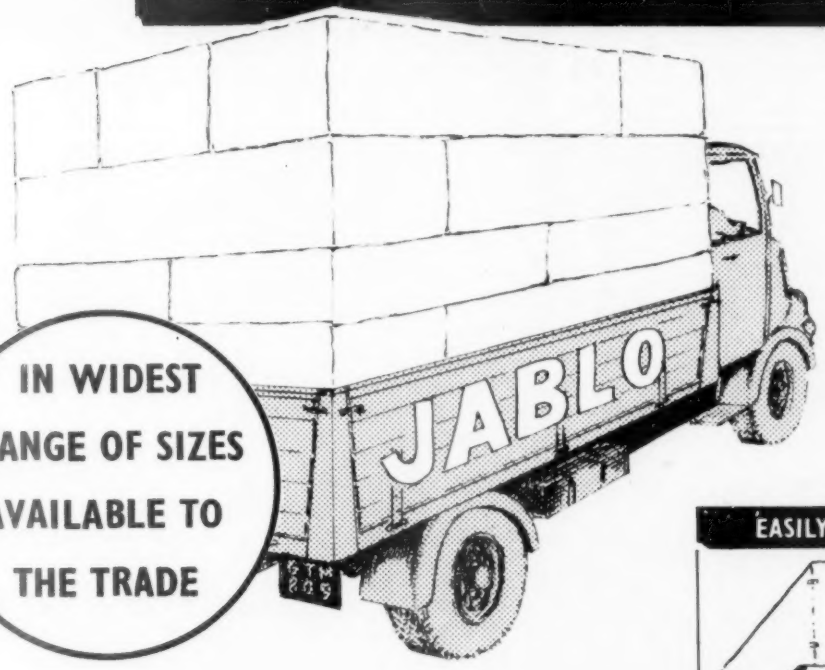
This feature will appear monthly throughout 1961 and possibly beyond. In July, a book prize will be offered to the person submitting the most correct answers to the first four instalments.

Replies should be addressed to the Managing Editor, "M.R." 131, Great Suffolk Street, London S.E.1.

These refrigerator liners are vacuum-formed from sheet material.

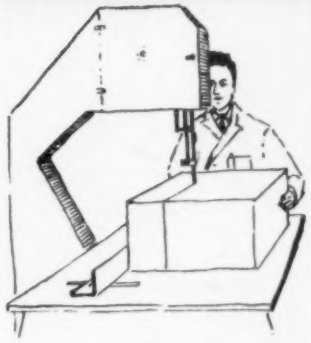
DO IT YOURSELF!

With JABLITE moulded blocks



IN WIDEST RANGE OF SIZES AVAILABLE TO THE TRADE

EASILY CUT TO SIZE



KEEP AHEAD WITH JABLITE

FIRST AND STILL THE BEST

If you have your own *cutting capacity*, you can really help yourself by seizing this great opportunity. JABLITE blocks are now available in lorry loads at the highly advantageous price of 4/10 per cubic foot ! ASK FOR ADVICE.

AVAILABLE BLOCK SIZES :

8′ × 4′ × 12″	12′ × 4′ × 12″	9′ × 3′ × 12″
7′ × 3′ × 12″	4′ × 2′ × 10″	5′ 6″ × 2′ 6″ × 12″

Enquiries direct to :

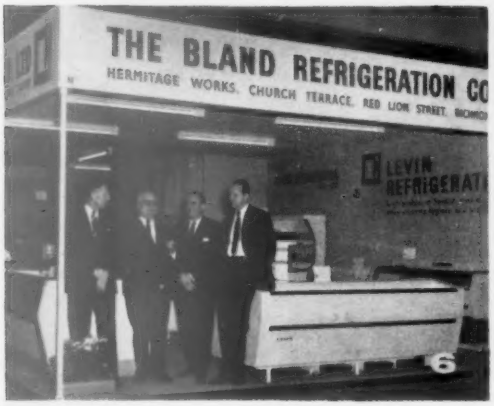
JABLO PLASTICS INDUSTRIES LIMITED

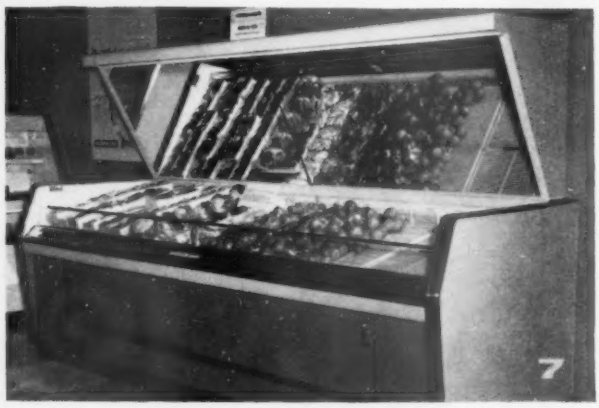
Jablo Works, Mill Lane, Waddon, Croydon

Telegrams : "Jablo, Croydon" Telephone : Croydon 2201-3

The Self-Service Exhibition

1. Smithfield Refrigerator featured McCray cabinets; 2. Hussmann's new three-tier model; 3. Atlas cabinets from Denmark; 4. New models presented by C.W.S.; 5. IWO shown by M. L. Winsor; 6. Mr. H. Henriz (r.) visits Mr. Bland (l. centre) on his stand with Mr. Bennett (1); 7. Hussmann's new MD-S-V9.





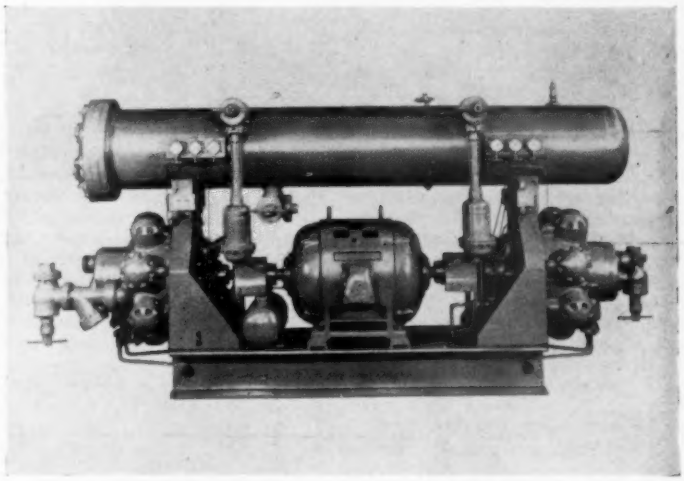
Air-Conditioning a Public Hall

Chrysler Airtemp Installation at London Dance Salon

AMONG recent improvements carried out by the Rank Organization to its Astoria Dance Salon in London's Charing Cross Road was the adaptation of an existing ventilation plant to modern air-conditioning.

The provision of a constant supply of fresh air is essential in most indoor places of entertainment. This is particularly necessary for dance halls, where, unless an efficient system of ventilation is provided, there is a danger of discomfort to patrons.

While the existing scheme supplied a 100 per cent. fresh air to the ballroom, its engineers realized they could not increase the air volume without increasing the size of the ducting through which the air would pass and without increasing the noise level. The duct size could not be increased because of space limitations. It was, therefore, decided to introduce air to the ballroom at a temperature lower than the ambient air temperature, by passing the air through a cooler battery.



Chrysler Airtemp radial condensing unit similar to that which was used in the installation carried out at the Astoria Dance Salon in Charing Cross Road. The condenser is an induced draught evaporative unit with 3 h.p. squirrel cage motor and a ¾ h.p. centrifugal water recirculator pump. Its dimensions are 7 ft. 6 in. long, 3 ft. 6 in. wide and 7 ft. 9 in. high. To maintain constant head pressure a motor controlled damper is provided in the condenser air discharge outlet.

The Rank Organization's engineers, in conjunction with Richard Crittall, therefore produced a scheme in which a Chrysler Airtemp 7-cylinder radial unit was considered to be the most compact refrigeration unit to fit into the confined space available. Because it was a standard unit, quick delivery could be assured.

Under the new system 100 per cent. fresh air is drawn into the building and passes through a filter sited before the cooler battery and thence passes through ducting. It is delivered to the dance floor through a number of adjustable air diffusers placed at high level in the galleries. This eliminates any possibility of draughts. Particular provision is made for supplying conditioned air to the bandstand.

The refrigeration equipment provided by Chrysler Airtemp Limited, which markets refrigeration, air conditioning and heating equipment in the United Kingdom, consists of direct expansion refrigeration plant with an evaporator condenser. The latter is extremely economical in the use of water—an important factor in London where water rates are high.

The following is a brief specification of the components used in the Astoria installation.

Compressor

One Chrysler Airtemp 2107 3-in. bore by 2¾-in. stroke 7-cylinder radial model type. The unit is arranged for direct drive from a 35 h.p. Brook screen protected slipring motor. This particular motor would be capable of developing 50 h.p. but it has been derated in this instance for quiet operation. The compressor runs at approximately 1,450 r.p.m. and no special anti-vibration precautions have been taken, yet perfect balance and quiet operation have been achieved. The compressor was completely unloaded at start up, thereby preventing high starting currents with the resulting drop in line voltage. As the ambient air temperature drops, only six cylinders are unloaded, and the ambient air temperature is the same as the desired delivery temperature. This system is therefore balanced at all times. Because the compressor is directly connected to the electric motor, belts and flywheels are eliminated. Also, being of the radial pattern, the compressor is completely in balance, permitting higher speeds and more refrigeration per horsepower. Maximum interchangeability of parts is an additional important feature of Airtemp equipment. The low resistance oil separator increases the efficiency of the system by reducing the oil content in the refrigerant by one-fifth of 1 per cent. The full load duty of the system is to extract 225,100 B.t.u./hr. from air at 70° F. d.b., 60 per cent. relative humidity, while passing 18,000 c.f.m.

Condenser

The condenser used is an induced draught evaporative unit with 3 h.p. squirrel cage motor and a ¾ h.p. centrifugal water recirculator pump. It consists of a nest of closely packed steel tubes mounted on support plates above a mild steel sump tank. Above this is an eliminator section together with centrifugal fan assembly. Coil assembly,

eliminator base tank and casings have been hot-dipped, galvanized and all other parts are suitably protected against corrosion. The dimensions of the unit are 7 ft. 6 in. long, 3 ft. 6 in. wide and 7 ft. 9 in. high. To maintain a constant head pressure a motor controlled damper is provided in the condenser air discharge outlet.

Evaporator

The evaporator consists of a battery of air cooling coils arranged in sections to ensure ease of handling on site. These coils comprise horizontal ½ in. o.d. copper tubes expanded on to the collars of smooth tinned copper. The assembly is housed in a galvanized sheet steel casing with galvanized steel angle frames around both faces, drilled for direct attachment to duct work. Coil resistance to air flow is 0·3 in. w.g.

The connexions used for the installation consist of a set of refrigeration interconnexions with requisite valves and fittings for coupling at the plant circuit. The chemicals used in the system are an initial charge of Refrigerant-12 and compressor lubricating oil.

The Chrysler Airtemp installation at the Astoria provides an excellent example of ventilation modernization. It shows how it is possible to modify an existing system.

IMMERSION FREEZER FOR TURKEYS

THE installation of freezing plant sets the poultry processor a difficult problem. He must keep his initial capital costs down, and yet allow for the formidable expansion that is likely to occur. Frigidaire solved this problem for Yorkshire Turkey Packers Ltd., of Dalton, Thirsk, by installing an immersion freezing tank large enough in size to meet all their anticipated needs, but with sufficient refrigeration for their immediate output only. Then, as output increased, more refrigeration was added. In this way, installing medium size units of refrigeration equipment, capital expenditure was kept in step with production and revenue.

At Dalton one 10 h.p. unit was installed to begin with, for an output of approximately 400 turkeys per day. As production incr ased, additional 10 h.p. units were added until the output had risen to the present-day figure of 2,000 turkeys per day, employing some 50 h.p. of Frigidaire equipment.

Immersion freezing has many advantages. Capital costs are lower than those for blast freezing ; a white flesh can be obtained without resorting to the extremely low temperatures that would be needed for blast freezing to produce comparable results ; less space is required ; flow production or batch production can be catered for ; and running costs are lower. At Dalton immersion freezing is carried out in a tank 30 ft. long by 5 ft. wide, filled with a calcium chloride solution at -20/-14° F. Before entering this tank the eviscerated birds are precooled in a spin chiller using flake ice or, if there is an overflow of production, are placed in tanks containing chilled water and slush ice. The birds are then " Cry-O-Vac" wrapped, put in the immersion freezer and kept submerged by means of a specially designed rubber conveyor.

The turkeys can be kept in the immersion freezer for any period ranging from 35 minutes to two hours. This flexibility is made possible by a control which varies the speed of the conveyor. It has the practical advantage that the immersion period can be varied to suit the needs of the evisceration line and the packing department—in fact, it can meet the day's production requirements. Equally important, perhaps, is the control given over the freezing to the manager of the plant. By varying the speed of the conveyor, and therefore the time the birds spend in the tank, he can increase or decrease the depth of freezing achieved in the immersion plant.

Freezing is then completed in an 8,000 c.ft. Frigidaire freezer room operating at zero/-5° F. Turkeys remain here for a minimum of 24 hours before being despatched to their various destinations in refrigerated vehicles.

E.R.A. PRESIDENT

The Electrical Research Association announces that Mr. James R. Beard, C.B.E., is to be its next president. Mr. Beard is the senior partner in Merz and McLellan, consulting engineers, and is known internationally for his work in the electrical field.

Educated at Manchester Grammar School and the University of Manchester, he received his early training with the North Eastern Electricity Supply Company and the Cleveland and Durham Electric Power Company, before joining Merz and McLellan. Mr. Beard was closely associated with the design and construction of the national grid system and the Scottish Hydro-Electric Schemes, and numerous electric power supply and traction schemes in Great Britain, South Africa, India and elsewhere. The president-elect has held many offices in learned societies, institutions and other organizations, being president of the Institution of Electrical Engineers, 1940-1 and subsequently being elected an honorary member. He was also president of the British Electrical Power Convention, 1953-4; chairman of the Association of Consulting Engineers, 1945-6; president of the Association of Supervising Electrical Engineers, 1937-9; chairman (appointed by the Minister of Works) of the Council for Codes of Practice for Buildings, Construction and Engineering Services, 1947-9; chairman of various committees of the British Standards Institution and of the Electrical Research Association; and a member of the Engineering Advisory Committee of the War Cabinet, 1941-5. Mr. Beard has presented many papers on electricity generation, transmission and distribution before the Institution of Electrical Engineers, the World Power Conference, C.I.G.R.E. and elsewhere.

During April, **Dr. H. G. Taylor,** director of the Electrical Research Association, paid a visit to New York, Toronto and Montreal. The primary object of his visit was to attend the annual assembly of the International Institute of Welding, held in New York from April 11 to 18. Dr. Taylor is chairman of Commission No. III which deals with resistance welding, and it is interesting to note that of the 15 commissions which cover all aspects of welding, the British hold the chairmanship of two. This year's assembly is the 14th of the series and is the first to be held in New York, all the previous ones having been held in Europe. Twenty-eight countries were represented and Britain sent a delegation of 25. Dr. Taylor went on to Toronto and Montreal where he visited a number of members of the Electrical Research Association and also various prospective members.

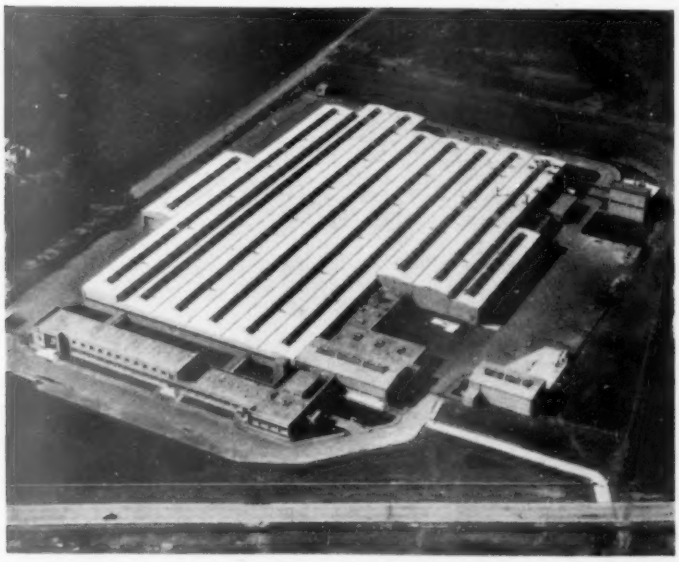
Morphy-Richard's large new factory in Dundee

"MR" presents step-by-step photographic record of Production in a modern Refrigerator Plant

The Minister of Power, the Rt. Hon. Richard Wood, M.P., officially opened the new Morphy-Richards (Astral) Ltd. factory at Dundee last month. The Minister of Power, (left), and Mr. Willis Roxburgh, chairman of Morphy-Richards (Astral) Ltd., and managing director of Morphy-Richards Ltd., are seen here at the opening ceremony where Mr. Wood unveiled a plaque at the entrance to the factory.

THE Minister of Power, the Rt. Hon. Richard Wood, M.P., last month opened the new factory at Gourdie, Dundee, of Morphy-Richards (Astral) Ltd., in the presence of a distinguished gathering which included the Lord Provost of Dundee, M. McManus, L.L., J.P., Lord Strathclyde, the Earl of Dundee, Lord Polwarth, T.D., Lord Hughes, Sir Garnet Wilson and Mr. J. C. Pinkerton; C.B.E., M.C., J.P., Industrial Estates Management Corporation for Scotland.

The hosts were Sir Joseph Lockwood, chairman, Morphy-Richards Ltd., and Mr. Willis Roxburgh, D.F.C., managing director, Morphy-Richards Ltd. and chairman of Morphy-Richards (Astral) Ltd.



This new factory covers an area of approximately 8 acres. It is one of the largest single factory units in Scotland and the largest making domestic appliances.

The plant, Scotland's largest domestic appliances factory, covers an area of approximately eight acres. The building has been specifically designed for high volume flow production of such products as refrigerators (only refrigerators are at present being produced there, although other white appliances are scheduled for production). The most up-to-date equipment and techniques have been introduced.

The new Gourdie factory brings the total production area for the whole of the Morphy-Richards Group to 810,000 sq. ft.

This is made up as follows :—

	sq. ft.
Gourdie	350,000
Three other factories at Dundee	216,000
Factories in Kent ...	244,000

Scotland, however, will remain the Group's production centre for major appliances, such as refrigerators and spin-dryers. The total site area at Gourdie is approximately 1,100,000 sq. ft. thus allowing for further factory extensions in due course. Morphy-Richards (Astral) Ltd., are one of the four largest refrigerator manufacturers in Britain.

The planning of the Gourdie factory was initiated in June, 1958, by Mr. W. Roxburgh.

The eight-acre factory, sited on the north-west Dundee city boundary, was built by Holland and Hannen and Cubitts (Scotland) Ltd., Edinburgh, for Industrial Estates

Part of the air compressor house for supplying compressad air through a ring main to all parts of the factory. Compressad air is used to assist a miscellany of operations throughout the works, including press work, spot welding, painting and the operation of small tools.

Management Corporation for Scotland, who are statutory agents for the Board of Trade in Scotland. The building, erected at a cost of approximately £500,000, is leased to Morphy-Richards (Astral) Ltd.

The factory and office buildings comprise a substantially rectangular structure approximately 750 ft. from north to south, and approximately 450 ft. from east to west. The roof is of the Warren Girder construction, having centre lights running north to south the full length of the factory.

The main factory production and service floor area under roof is 315,000 sq. ft., in addition to which, the administrative block, boiler-house, garage, canteens, and kitchen, comprise 35,000 sq. ft.

The administrative block is a two storied rectangular building running the full length of the front of the factory (*i.e.* the south side), and is separated from the main building by a courtyard.

Two canteens, a dining room and kitchen are located in the south-east corner of the factory. A boiler-house and garage are located to the north-east and south-east of the site respectively, and separated from the factory buildings by a roadway and vehicle marshalling area.

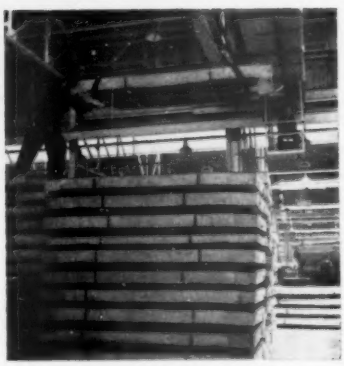
The factory floor is approximately 12 in. of concrete with granolithic finish ; it is at one level, with the exception of the off-loading and loading bays.

The building has been specifically designed for the flow production of major domestic appliances particularly refrigerators.

Material flow is intended from west to east—so that on the west side of the factory is a covered off-loading section where the floor level is 3 ft. 6 in. below that of the main factory floor, and on the east side is a covered vehicle loading section, again with the floor 3 ft. 6 in. below that of the main factory.

Immediately east of the off-loading section is the stores area, and crane bays are provided to the north and south of this section for handling the heavier incoming materials.

To the north-east of the main production area is a finishing department of some 20,000 sq. ft., separated from the production area by a partition wall. Again, on the east side, and south of the finishing department, are located ancillary buildings for providing electric power, compressed air, and processing services.



Handling of sheet steel by overhead travelling crane in the steel store prior to processing.

Over the main production area the roof ties are located 14 ft. above floor level ; in the crane bays and the product finishing section, the height is extended to 22 ft.

A second floor is provided on the west side over the central stores area and on the east side over the despatch area.

Plant and Equipment
Cabinet Production

This is located in the northern half of the factory, where the north crane bay handles incoming sheet material.

The material is processed from west to east, involving the following major operations :

1. Cutting the sheet to size on power guillotines.
2. Fabricating the cabinet on power presses and press brakes, employing special purpose tooling.
3. Assembly of the cabinet components by the spot welding technique, utilizing a variety of specially designed jigs and equipment.

After the cabinet is fabricated, it is placed on an overhead monorail conveyor and delivered to the finishing department.

The finishing department, or paint shop, is of special interest and significance, because it embodies the most up-to-date processing plant available.

The fabricated cabinet, on delivery by monorail conveyor within the finishing department, is first of all transported through an automatic trichloroethylene degreasing system at high level, after which it is delivered to the centre of the finishing department at low level and is ready for painting.

Here the cabinets are removed from the degreasing conveyor, inspected, and loaded on to the main paint conveyor. On this conveyor the cabinets are stove enamelled, inspected, and ultimately delivered at high level to the west side of the factory for the commencement of final assembly operations.

The automatic painting equipment comprises two large paint spray booths, and two large stoving ovens. These deal with the application of primer coat and finish enamel coat respectively. Each automatic spray booth houses six automatic painting machines which are electronically and mechanically controlled. The result is almost completely automatic coverage with the absolute minimum of hand work. The stoving ovens are elevated, and together comprise 4,200 sq. ft., and underneath them is located the heating burners and control equipment. The oven for drying the primer coat is direct gas fired, whilst the enamel drying oven is indirectly fired by oil. Both ovens are heavily insulated for economical running.

Sheet steel being fed into a power guillotine for cutting to shape to form refrigerator cabinets.

The conveyor feeding this plant runs without interruption, so that very precise production control can be effected.

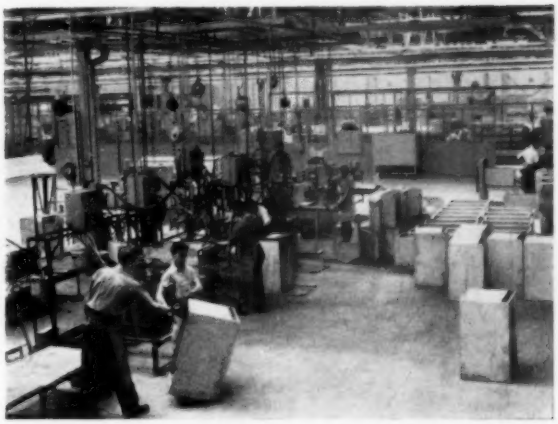
The conveyor system is of particular interest in the way the cabinets are handled without interruption to the flow of work, and the electronic devices incorporated in the automatic machine system ensure that no paint materials are wasted.

Filtered warm air is provided to each booth under pressure, to ensure that the atmosphere within the painting area is dust free, and this air passing through the booth carries with it particles of paint overspray through a high pressure water screen, where the paint particles are coagulated so that only the clean air is exhausted to atmosphere. The main feature of this plant is the economy with which paint can be applied to a variety of different shapes, and with the minimum idle time when changing from one product to another.

A separate paint stores and mixing house adjoins the main finishing department, where painting materials are automatically mixed and pumped to the paint spray booths. The paint is continually circulated at uniform temperature, and provision is made for instantaneous colour change.

It has been said that the finishing shop conveyor system delivers the painted cabinet to the west side of the factory at high level. Here the conveyor on the delivery side is dipped in four sections to coincide with the commencement of each of four power operated final assembly conveyor lines.

The final assembly conveyors are of the wooden slat type, located 18 in. above floor level, and here again the cabinet continues to move, whilst assembly of the component parts comprising the complete refrigerator takes place.



General view of one of the refrigerator cabinet spot welding production lines operating on the "follow on" principle.

The east end of the final assembly conveyors terminates at the despatch area.

These conveyors, in addition to providing the space necessary for the final assembly operations, also include provision for electrically testing the finished product, and adjacent to the conveyor is a test room which operates at high ambient temperature, and into which a percentage of the production is by-passed, thus providing a continual check on quality.

Much of the plant is already installed and operating, but it will be some months before installation is complete.

Absorption Cooling Unit Production

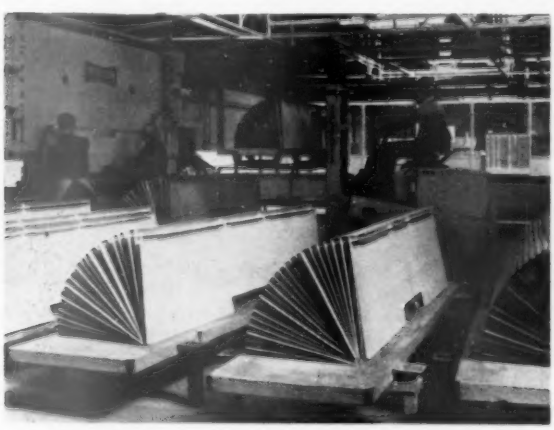
No plant is yet installed for the manufacture of cooling units, this work being presently and for the next few months, catered for by one of the other Morphy-Richards (Astral) Ltd. factories in Dundee.

The basic production plant, however, is finalized, and plant and equipment are on order.

The south crane bay is designed to handle incoming materials, mostly seamless steel tube and steel strip, and again, the production flow is from west to east.

The plant to be provided here includes a semi-automatic degreasing system, tube bending machines,

A powerful brake press is used to blank and form the refrigerator door from a flat sheet.



The edges of the cut steel being flanged on a hydraulic power press.

welding equipment, and an automatic charging plant. In addition, conveyorised tube cleaning and galvanizing plant is to be installed.

A particular feature of cooling unit construction is the necessity for first-class welding conditions. To provide these conditions, oxygen and acetylene gas is delivered through a ring main to weld points throughout the section. The ring main is to be fed by an automatic cold evaporator oxygen plant, and an acetylene gas reservoir.

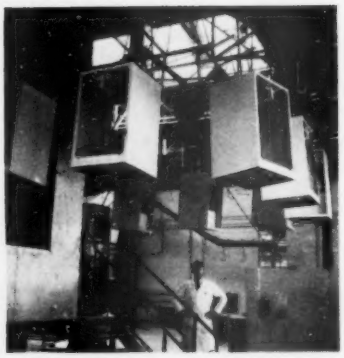
The cooling units, after manufacture, are air tested by high pressure, to ensure weld soundness, and are then placed on an overhead

One of the spot welding operations on the refrigerator cabinets. For these operations quick release jigs are used to ensure the correct final shape of the cabinet.

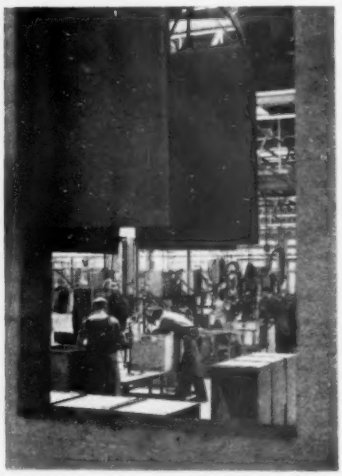
Rock fibre insulation being placed in the cabinet prior to the fitting of the interior.

Inspection of the refrigerator door prior to finishing.

Right foreground: one of the gas burners providing heat for the stoving ovens in the finishing department. The insulated ovens are located above the combustion chamber by means of the hot air ducts shown.

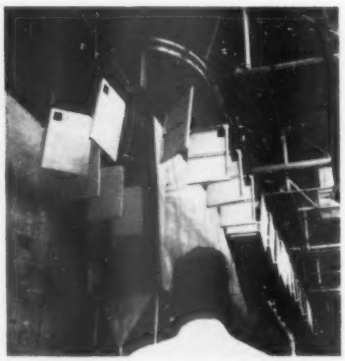


Cabinets being transported by the overhead conveyor into the automatic paint spray plant, where the primer and enamel coats are applied.



After spot welding (background) the refrigerator cabinets are delivered by the overhead conveyor shown to carry them into the finishing department.

Fitting the magnetic self-sealing plastic gasket round the edge of the refrigerator door.



Overhead monorail conveyor carrying refrigerator cabinets and doors from the degreasing plant. After inspection, a second monorail conveyor transports the cabinets and doors through a paint spray plant.

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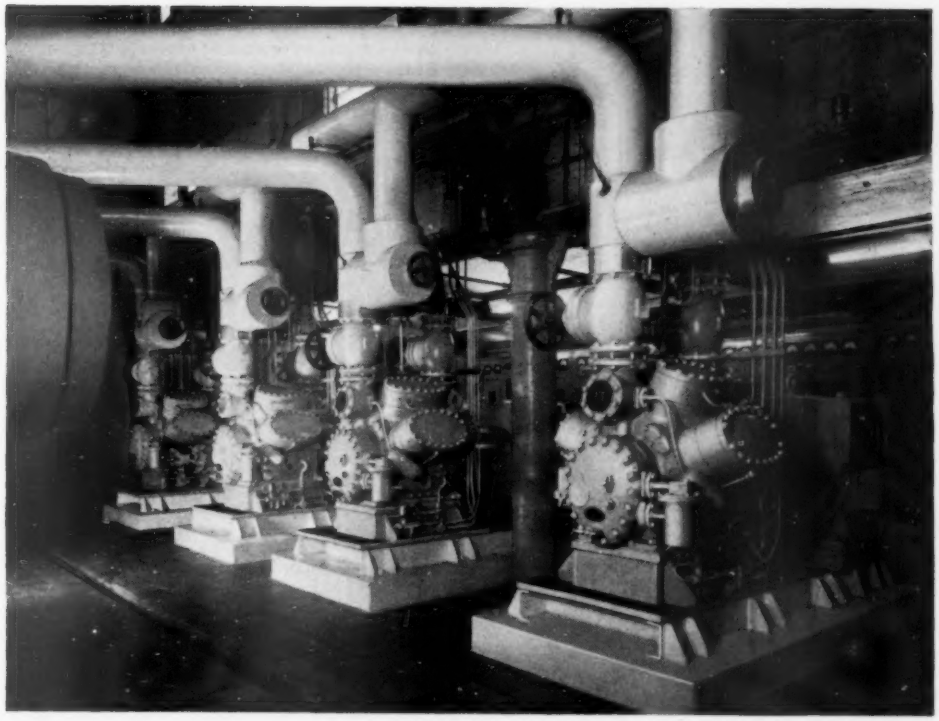

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In brewing, for example, it plays a controlling part in all the processes. The illustration shows the four, 8-cylinder, 5" x 4" veebloc compressors, using ammonia as a refrigerant, supplied to Mann, Crossman & Paulin Ltd., Albion Brewery, London, E.C.1.

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AP 375

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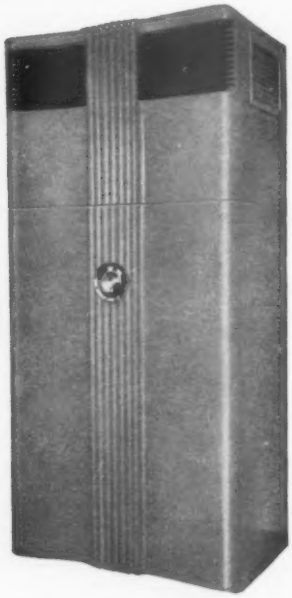

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Ideal for use singly or in multiples. Housed in an attractive cabinet, it utilises serviceable hermetic refrigerating compressors with air—or water cooled conditioners. Capacities of these units in various sizes range from 2 to 15 tons.

Fitting the evaporator cover to the evaporator tubes. Right: fitting components to rear of refrigerator.

Background: part of the refrigerator stock prepared for onward transit. Foreground: part of the absorption cooling unit stock. (These units are presently manufactured in another of the Morphy-Richards factories.)

The first stages of final assembly which takes place on a power operated slat type conveyor. In the foreground, the insulating of the cooling unit is shown, prior to fitting into the cabinet. The female operator at the rear is preparing sub-assemblies for fitting on the conveyor line.

Final assembly conveyor. Fixing plastic interior liner to cabinet.

Lower foreground: fitting door and interior components to refrigerator cabinet. Top and background shows the conveyor delivering finished cabinets and doors from the finishing shop to the commencement of the final assembly conveyor lines.

View of part of the insulated test house. Here the refrigerators are performance tested in an ambient temperature of 90°F.

Delivery end of the final assembly conveyor showing cabinets being packed for transportation.

monorail conveyor where the operations of de-scaling, phosphating, painting, and stoving are automatically carried out prior to delivery to the test area.

Each cooling unit is separately tested under working conditions, after which it is delivered by overhead monorail to the final assembly refrigerator lines for assembly to the finished product.

Despatch and Storage of Finished Goods

The four final assembly lines previously referred to, terminate in the despatch and loading section, and the last operation before handling in the despatch area, is the protection of the refrigerator by its packing materials.

The despatch and loading area is of two floors, each of 20,000 sq. ft., the top floor being devoted to the storage of carton materials and finished products.

The ground floor provides immediate access on the east side to the vehicle loading bays, and the movement of products within the area is controlled and assisted by power conveyors.

The final assembly conveyors from the manufacturing area join up with a perimeter power conveyor within the despatch area, and provision is also made on the conveyor for automatically diverting products. where so desired, to an elevator where those products for storage are automatically elevated to the upper floor. The perimeter conveyor allows the product to circulate within the despatch area so that the product can be removed at the nearest or most appropriate point for its loading.

Provision is also made by segregation for vehicle loads to be performed so that the vehicle loading time is reduced to a minimum.

Goods Inward and Storage Section

The total area is approximately 45,000 sq. ft., and the north and south crane bays are each serviced by a 3 ton overhead travelling crane. The centre section of the stores, which divides the crane bays, is provided with two floors, the lower of which is in direct access to the goods inward covered unloading bay. The upper floor of the centre section is serviced by a 2 ton automatic joist, and two flat belt elevators.

The centre section is divided from the production area by wire mesh steel partitions.

The canteen and kitchen are of the most modern layout.

We are indebted to Morphy-Richards (Astral) Ltd., Dundee, and to Birks-Thorne Ltd., London, for their help in preparing this illustrated article.

Massive Aircraft may be used for flying Frozen N.Z. Produce to Markets

LARGE-scale air transport of refrigerated cargo, such as New Zealand meat and fish, is deemed practicable, and, convinced of this, Canada's largest manufacturer of aircraft, recently sent top executives to Wellington to impress the Government, aviation and refrigeration interests with the potential of such transport for New Zealand produce.

They believe that development of air carrying of refrigerated cargo could lead to expansion of New Zealand's export trade and the opening of new markets, with saving of overseas exchange by using a New Zealand fleet of air carriers with freight costs coming to New Zealand.

While in Wellington the executives presented to the Government details of the investigations which led the company to the conclusion that refrigerated transport of bulk cargoes of produce is already practicable and economically feasible.

Canadair's investigations arose out of discussions, general and often informal in character, in New Zealand last year of the possibility of sending farm products overseas in massive freighters.

Of the practicability of refrigerated air cargo, the Canadair representatives said that though New Zealand had prompted the immediate investigations the principles would have world-wide implications—fast transport of meat between South and North America, of dairy products, across the Atlantic and of a great range of perishables within the continents.

While air transport of primary frozen products in bulk was not, and probably never would be, directly competitive in carriage cost with surface transport, an immense expansion was ahead in the way of refrigerated goods carried by air.

The executives pointed out that the cold carriage development envisaged was not of refrigeration of the full holds, but of self-sufficient cold containers—10 oversize household containers, as it were—rolled into the upper hold, each of over 300 c.ft. capacity with its own freezing unit, operable either from the aircraft's generators or from ground power supply.

Thus cold storage of normal freight could build up the payload, or, for that matter, freight according to need and passengers. The containers could be loaded ashore at any point and held cold for any period until rolled into the aircraft. At destination the freezing unit would be supplied with power from ground sources, except while in road transport.

It was pointed out by the visitors that in flight on ocean and far distant stages the aircraft flew in bitter cold, but the hurdle against air-freighting of foodstuffs was high temperatures at refuelling in the tropics and at summer continental points, with always the possibility of delays for engine failures along the journey. Wherever there was electrical supply the container temperature could be held low.

The delegation said that there were short as well as long haul prospects for refrigerated air cargo of importance and members of it suggested that New Zealand fly fish to Australia and meat and fish from the Chatham Islands.

With a full refrigerated fish payload across the Tasman, the direct operating cost of the Canadair freighter would work out at 3d. a lb., or 6d. allowing for a 100 per cent. addition of overhead costs.

New Prestcold appointments include: Mr. N. C. Crowe, appointed general manager, Prestcold (East Anglia) Ltd.; Mr. A. G. Roberts, appointed branch manager, Kent branch; Mr. R. W. E. Dimmick, appointed commercial sales manager, Kent branch; following the appointment of Mr. F. R. Best as field sales manager—domestic, Mr. J. D. Andrews has been appointed southern area manager —domestic (*see also p.* 620).

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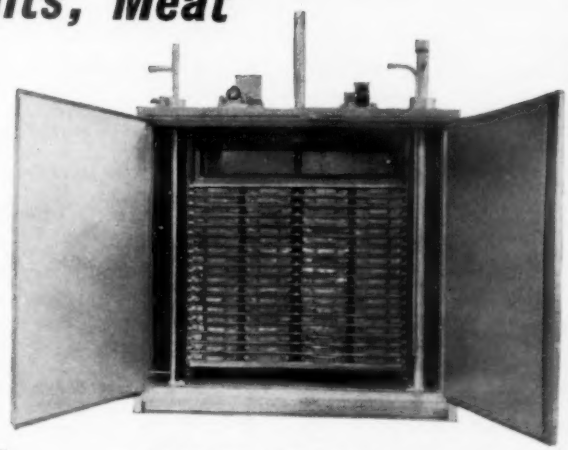

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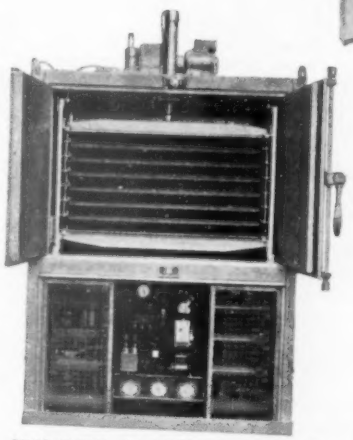

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The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694)

REFRIGERATION IN THE CHEMICAL INDUSTRY

A short course on "Refrigeration in the chemical industry" will be held at the Bradford Institute of Technology on Thursday and Friday, June, 29 and 30. The fee for the course is £1 10s. and further details and forms of application may be obtained from the Head of the Department of Chemical Engineering, Bradford Institute of Technology, Bradford, 7, Yorks.

SYMPOSIUM ON THERMAL INSULATION

At the joint meeting of the Institute and the Low Temperature Group of the Physical Society and the Institute of Physics held on March 2, 1961, Professor G. G. Haselden, B.SC., associate member, and Mr. G. H. Martin, B.SC., gave a paper on "Factors controlling heat-leakages into large scale storage tanks for liquefied gases."

FACTORS CONTROLLING HEAT-LEAKAGE INTO LARGE STORAGE TANKS FOR LIQUEFIED GASES

1·0 Introduction

The design of large storage tanks for low temperature liquids such as methane and oxygen presents a number of interesting challenges. In general the cost of reliquefaction of the boil-off gas is high so that very little heat inleak can be tolerated—normally a boil-off rate well below 1 per cent. of the tank contents per day is aimed at. However, these storage tanks can normally be justified only if their capital and maintenance costs are low. Hence great economy in design is essential.

Vacuum insulation, though much more efficient than other forms of insulation, is only of special advantage with small tanks and pipelines for which the surface to volume ratio is high. In such cases the effective area of conduction through the lagging increases rapidly as additional layers of insulation are added; hence the outer layers are less and less effective. For very large tanks the insulation behaviour approaches closely that of a flat wall and the thermal resistance is nearly proportional to the lagging thickness. Thus for large tanks the choice of insulant is governed primarily by the cost per unit of installed thermal resistance. On this basis powered or fibrous insulants are normally prefired and the optimum thickness of lagging is around 2 ft. to 3 ft.

The use of such large thicknesses of lagging leads to at least two problems which are not normally encountered. Firstly, the large volume of lagging allows natural convection currents to occur within it, and these may cause a significant increase in the overall heat transfer. Secondly, a large process lag occurs between the occurrence of a temperature change on the outer wall of the tank (due to change of atmospheric conditions) and the resultant evaporation rate at the inner wall. It is therefore difficult to make an exact analysis of tank behaviour. These two problems are the subject of the present paper.

2·0 Convection Effects

We will consider two vertical plates at uniform temperatures T_i and T_o separated by insulation which offers little resistance to gas flow. The difference in densities of gas in different regions of the insulation will cause pressure gradients to be set up which will in turn result in a flow of gas and the transfer of heat by convection.

Various workers have demonstrated the existence of convection currents by dividing large specimens horizontally by thin partitions (1), varying the density of compressible material (2), testing different thicknesses (1), using different temperature gradients (2), or reducing air pressure in the pores (3). Little of this work, however, has been of a quantitative nature and almost all of it has been carried out on small conductivity cells of the order of 1 in. in thickness. A paper by Lorentzen and Brendeng (4) describes tests on sections about 3 ft. by 5 ft. with various types of insulation and reports that free convection adds considerably to the heat leakage in an insulating wall for low density materials. Little attempt has been made up to the present to correlate different data or to find a method of allowing for its effect in design calculations. All of the above mentioned work has been done at atmospheric temperature and above, but the effect of convection would be expected to be greater at low temperature where gas viscosity is reduced and density is increased.

2·1 Dimensional Analysis

The variables which influence heat transfer by convection in a porous material are

Gas density ... ... • ...	ρ	lb. ft.$^{-3}$
Gas coefficient of expansion	βg	ft. hr.$^{-2}$ °F.$^{-1}$
Gas specific heat	$C\rho$	B.t.u. lb.$^{-1}$ °F.$^{-1}$
Gas viscosity	μ	lb. ft.$^{-1}$ hr.$^{-1}$
Gas conductivity	k_g	B.t.u. ft.$^{-1}$ hr.$^{-1}$ °F.$^{-1}$
Conductivity of insulation	k_i	B.t.u. ft.$^{-1}$ hr.$^{-1}$ °F.$^{-1}$
Permeability of insulation	a	ft.^{2}
Height of insulation ...	H	ft.
Thickness of insulation ...	L	ft.
Temperature difference ...	ΔT	°F.

q = heat transferred across the insulation per unit area per unit time.

It may be shown from dimensional analysis that

$$\frac{qL}{Kg\,\Delta T} = f\left(\frac{H}{L}, \frac{k_i}{k_g}, \frac{a}{L^2}, \frac{C\rho\mu}{kg}, \frac{L^3\rho^2 Bg\Delta T}{\mu^2}\right)$$

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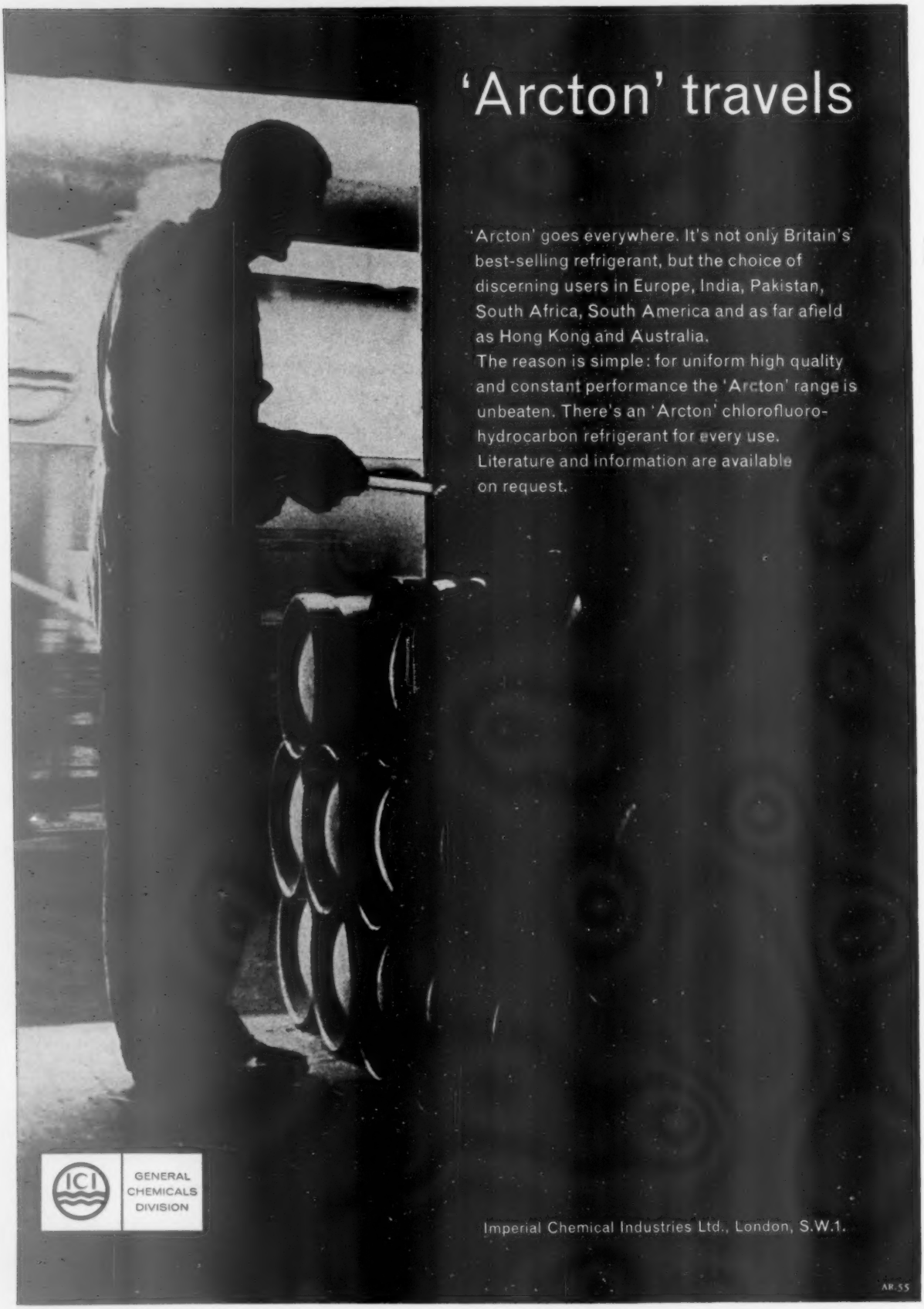

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ICI GENERAL CHEMICALS DIVISION

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$$\text{i.e. } Nu = f\left(Pr, Gr, \frac{k_i}{k_s}, \frac{\alpha}{L^2}, \frac{H}{L}\right)$$

where Nu = Nusselt group
Pr = Prandtl group for the gas
Gr = Grashof group for the gas

At present there is insufficient data available to enable the form of the above relationship to be determined.

2·2 Theoretical Approach

In considering the additional heat loss brought about by convection it is desirable to establish whether this arises solely due to the transfer of sensible heat in the flowing gas or whether the passage of gas through the material leads to an increase in its effective conductivity due for instance to micro turbulence in the pores. This last effect is best determined by direct measurement and a few experiments have been carried out on slag wool and Bretite to determine the effective conductivity while gas was flowing through the pores.

Slag wool showed no appreciable increase in conductivity for a gas flow of 4 ft.^{3} per hour ft.^{2}. Brelite showed less than 10 per cent. increase when gas was flowing at 5 ft.^{3} per hour ft.^{2}. These flows are considerably greater than those which would be expected due to convection effects and it may be concluded that this effect is small compared with the effect of heat carried as sensible heat by the gas.

An exact mathematical solution to the problem of convection is difficult but a study of the mechanism of the convective heat transfer shows how an approximate finite—difference method could be used to find a solution.

Suppose that initially there is no convection occurring, then the isotherms will be vertical and parallel (equally spaced if K is assumed constant with temperature). Assuming (to maintain symmetry) that the pressure across AB (mid-way down the insulation) is constant, the pressure at other points may be calculated from the gas density and distance above or below AB.

It may be seen that there are now pressure gradients in the horizontal direction which will cause the gas to flow carrying heat and distorting the isotherms.

If the insulation is considered to be divided into a number of small elements, the pressure and temperature in each element may be calculated, as a first approximation. Thus it will be realized that the mass flow into each element from the surrounding elements may then be calculated from the pressure gradients and by carrying out a mass balance on the element a new approximation to its pressure may be found. Similarly a heat balance including the heat flow by conduction and the heat carried as sensible heat by the gas enables a new approximation to the temperature to be found.

Repeating the calculations several times will produce a reasonably accurate approximation to the final temperature and pressure distribution.

The rate of heat transfer may then be calculated by summing the amounts of heat transferred both by conduction and gas flow for all elements along any vertical plane through the lagging.

This method of solution would be too laborious for hand calculation but could be programmed for solution by computer.

2·3 Experimental Approach

The laboratory investigation of the problem of convection is limited by the difficulty of carrying out measurements on large volumes of insulation. A study of the mechanism and equations expressing the flow, however, show that the effect of convection may be greatly increased by increasing the gas pressure in the pores.

A laboratory scale apparatus is under construction to measure the heat transfer in porous insulation by a guard ring method using a test section approximately 4 ft. high and 1 ft. thick. Provision has been made for increasing the gas pressure to about 10 atmospheres and also for reducing the gas pressure. Measurements will be made with one plate at (approximately) liquid oxygen temperatures and the other at room temperature and also with one plate at room temperature and the other at temperatures up to 200° C.

3·0 Effect of Transients on the analysis of the performance of industrial scale installations.

The rate of evaporation from large storage tanks is influenced by changes of both atmospheric temperature and pressure. The exact analysis of their boil-off performance is thus difficult. With both types of variation there will be a transfer lag between the change and its effect.

3·1 Effect of Atmospheric pressure changes

The authors gave variations in atmospheric pressure over a period of about 7 days, the maximum rate of change of pressure with time being about 0·6 millibars/w. The effect of increasing atmospheric pressure is to raise the boiling point so that some of the heat being transferred into the liquid is used as sensible heat in maintaining the liquid temperature at the boiling point.

Calculations on a particular storage tank for liquid methane 50 ft. in diameter and containing about 1,000 tons of liquid (*i.e.* a depth of approximately 45 ft.) show that a rise in pressure of 0·6 millibars per hour would be equivalent to a rise in boiling point of 0·013°F. per hour and the heat required to maintain the bulk liquid temperature at the boiling point would be 24,000 B.t.u. per hour. This value is comparable with the calculated heat in-leak for the tank and so will be expected to exert a very large influence on the rate of evaporation.

This effect would be easily calculable if there were no time lag involved in the transfer of heat from the walls of the tank to the bulk of the liquid. Such a time lag would, however, be expected but its effects are not easily predicted.

A considerable amount of work has recently been reported on the effect of pressurizing liquefied gas storage tanks of sizes up to a few thousand gallons (5, 6, 7). The pressure rise causes an immediate temperature increase at the free liquid surface, due to condensation, but the bulk of the liquid heats up only slowly as heat is received through the walls of the vessel. A similar situation will arise with large tanks, but it will be accompanied by the action of large convection currents within the liquid mass due to temperature inequality and even due to the presence of bubbles near the wall. Uncertainty as to the influence of these convection currents mades the prediction of pressure response virtually impossible. A decrease of atmospheric pressure will lead to an enhanced evaporation effect. The resulting bubble generation within the liquid will probably lead to increased liquid circulation and hence to a shorter transfer lag.

It is therefore vital, when analysing the behaviour of large storage tanks, to choose a test period during which the change of atmospheric pressure is small. Alternatively, though less satisfactorily, a period must be chosen over which atmospheric pressure has gone through, as near as possible, a complete cycle from a period of increasing pressure, through a period of decreasing pressure and back to a period of increasing pressure (or vice versa).

(*To be continued*).

SHOP REFRIGERATION NEWS

SALAD DAYS ARE HERE

By Our Special Correspondent

REFRIGERATION makes such slow progress at retail level in the fruit and vegetable trade that I seize every opportunity, however unorthodox, of bringing to notice examples of greengrocers' enterprise in displaying their produce under temperature-controlled conditions.

Last month, in the course of a visit to Tenbury Wells, Worcestershire, I passed an open-fronted greengrocery shop in which there was a sloping refrigerated slab given up to a mass display of salads. In all my long and close association with food shops, I had only once before seen anything looking so fresh and colourful. The slab was moderately proportioned with a low glass protective screen on all four sides, of the type widely used by fishmongers—a Golden Hind model operated by Prestcold machinery.

The owner of the shop, Mr. C. E. Dipper, in addition to being a greengrocer, is a fishmonger, fish-fryer, grocer and provision merchant, carrying on all his businesses in Market Street. Fish, fruit and vegetables are sold in one shop, while the fish-frying business, embodying a restaurant, is a few feet away, and the grocery and provision shop is on the other side of the road. A few months ago, Mr. Dipper invested in a refrigerated cabinet for displaying his stocks of wet fish. Instead of selling the slab which had been used up till then for that purpose, he turned it over to the display of salads. The change was beneficial to both classes of products as their sales have been steadily increasing.

The other example of a refrigerated slab used for the display of salads which came to my notice

A refrigerated fish slab converted for vegetable display at Tenbury Wells.

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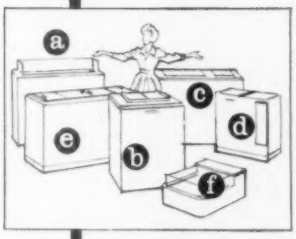

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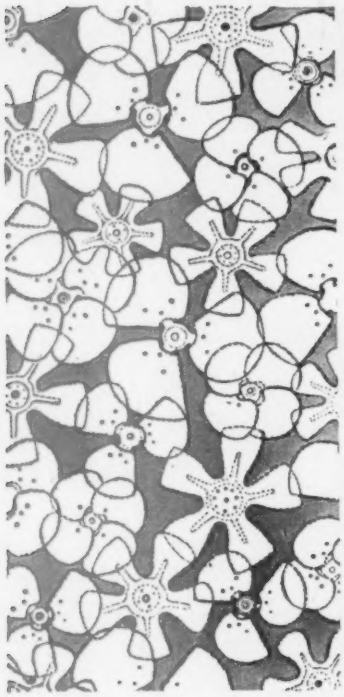

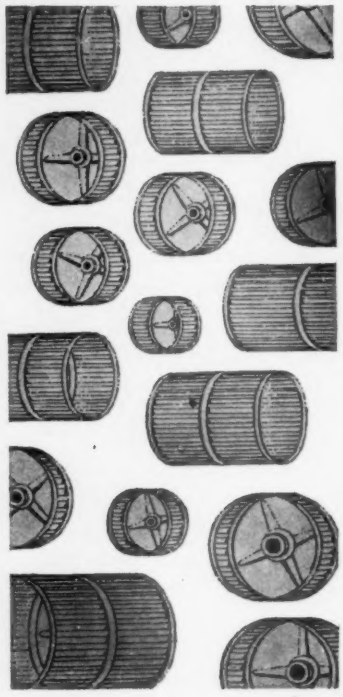

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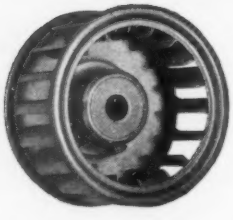

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Another interesting example of use of a refrigerated display by a greengrocer: in Dewsbury, Yorks.

was in the shop of S. B. Fruiterers Ltd. at Dewsbury, Yorks. This is again a combined fruit, vegetable and fish business, and the slab is by Prestcold. In this instance, however, it is used for salads in the summer only, and during the relatively short strawberry season, the salads share the space with punnets of this quickly - perishable soft fruit. Through the winter months it is used mainly for fish and at times for poultry.

The moral of these adaptions is that, notwithstanding the apparent reluctance of greengrocers to use refrigeration for the display of fresh produce, there are retailers in this trade who do realise the value of temperature-controlled equipment for keeping the more quickly perishable kinds of stock, salads and soft fruits particularly in a fresh, healthy-looking condition, and who make that fact evident by attractive display.

The lesson to be learned from these two examples, which are virtually improvisations, is that there is scope for the study of the requirements of salad display under refrigerated conditions : that something on the lines of a modified fish slab might well be devised for the greengrocer's use.

It is vitally important that all those members of the refrigeration industry—executives, representatives and back-room boys alike—who are concerned with the design, construction, and sale of equipment for use in food shops, should realise two facts about greengrocers :

(1) that there is a larger proportion of shops equipped with frozen food cabinets in this trade than in any other.

(2) that with the rise of the supermarkets (all of which stock fruit and vegetables), individual greengrocers are setting higher standards for the presentation of their merchandise.

These two facts indicate the vitality of a trade that is progressing without being bolstered by buying groups. Instead of by-passing the shop which carries on its fascia descriptions like those described above, the representatives of refrigeration equipment specialists should cultivate the friendship and confidence of their owners.

If this contact is maintained, greengrocers will be encouraged to associate the idea of refrigerated display with salads, and to appreciate the marked difference in appearance by, say, 3 p.m., of lettuce (as one example) that has been displayed under refrigerated conditions and partially protected, and lettuce that has been fully exposed to the normal temperature of the shop and also to indiscriminate handling.

There are now several standard cabinets, made to join on to one another to form a continuous line of display. Where the shop is sufficiently large to permit the use of cabinets in pairs, the approach to the greengrocer might well be in terms of quick-frozen foods *and* salads : in other words, a combined installation. One example of the kind of cabinet I mean is the Hussmann twin-department case, illustrated on page 1164 of last November's edition of MODERN REFRIGERATION.

For the counter-equipped shop—and many greengrocers still prefer to sell over the counter—it would probably be more practical to suggest a compact counter-top type of refrigerated slab of which there are several different models available. Examples which come to mind are the Winget Crystal Cooltop, J. Samuel White's Panorama, Drake's and the Lec model C.T.6.

Still with the improvement of the greengrocery shop in mind, and taking account also of the growing receptiveness of the greengrocer to proposals for such improvements, I feel it is timely to mention another kind of refrigeration singularly appropriate for the larger shops in this trade.

For the shop with the space to use it to advantage, and perhaps more particularly for the fruit and vegetable section of the food-hall in the department store, there should now be scope for the sale of ice-making machines enabling salads and soft fruits to be displayed on or surrounded by ice-flakes or cubes.

Two recently introduced models I have seen. One makes ice in the form of solid clear cubes and the other produces flake ice. These two machines are merely representative of a large range made by the Scotsman division of the King-Seeley Corporation, U.S.A., who claim to be the largest makers of ice-machines in the world. They are available from M. L. Winsor & Co., Ltd., who point out that when flake-ice is used as a bed for vegetable display shrinkage is reduced as the products gain as much as 7 or 8 per cent. more weight. The moisture provided by the ice also increases the eye and taste appeal of the produce.

Greengrocers should be encouraged to make much more use of the counter-top type of refrigerated display medium. An excellent example of use of one of these useful features for salad display is provided by the fruit and vegetable shop of Mr. Goggin at Sheerwater, near Byfleet, Surrey.

This has become quite a magnetic feature. Sited in the centre of the shop, it is an Enterprise model by Eldwood and was installed by Denver House (Sales) Ltd. of Leatherhead.

COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and Distributors' News

The Prestcold Division of Pressed Steel Co. Ltd. announce the following appointments :—**Mr. F. W. Harriss** has been appointed marketing manager, commercial, and will be responsible to the home sales manager for all activities covering sales of Prestcold commercial refrigeration equipment. **Mr. J. Parker** until recently deputy general manager of the London region has now been appointed general manager and will be responsible for all Prestcold activities in this region. **Mr. P. F. Hodge** has been appointed general sales manager London region. He will be responsible to Mr. J. Parker, the general manager of the London region, for all sales activities, including domestic, commercial and contracts. In addition, he will deputize for the general manager during periods of his occasional absence from the London region. **Mr. H. Higson** has been appointed manager of the North Wales branch and will be responsible to the home sales manager for all sales and service activities within his area. **Mr. F. R. Best** has been appointed field sales manager, domestic, in a national capacity and will be responsible to the domestic marketing manager for sales. He will also assist marketing units in the training and direction of the outside domestic sales staff. (See also p. 610).

Mr. Stanley Broughton (left), managing director of Electrolux, presenting Mr. H. Playle with a gift from his friends in the company at a dinner held recently in Belfast. Mr. Playle, who has retired, played a prominent part in building Electrolux business in Ireland.

* * *

Mr. T. A. Clibbon of Ruislip, Middlesex, has joined Controls Company of America (U.K.) Ltd., as refrigeration and air-conditioning sales manager. Readers will recall that he was associated with the Teddington Group for over 11 years, initially with the parent company, The British Thermostat Co. Ltd., as assistant export manager and subsequently as export manager. On the formation of their subsidiary some years ago, Teddington Refrigeration Controls Ltd., Mr. Clibbon was appointed home sales manager and held this position until he left them early last year. He is an associate of the Institute of Refrigeration, and a member of the executive council of the Refrigeration Servicemen's Association.

PRESTCOLD INTRODUCE NEW CABINETS

Prestcold's latest open food cabinet—the OFC 382—can now be had in two versions ; the Retailer Major or the Vender Major. The OFC 382—is the latest from a long line of successful cabinets and has been designed to provide increased storage space within modest overall dimensions and at an economical price.

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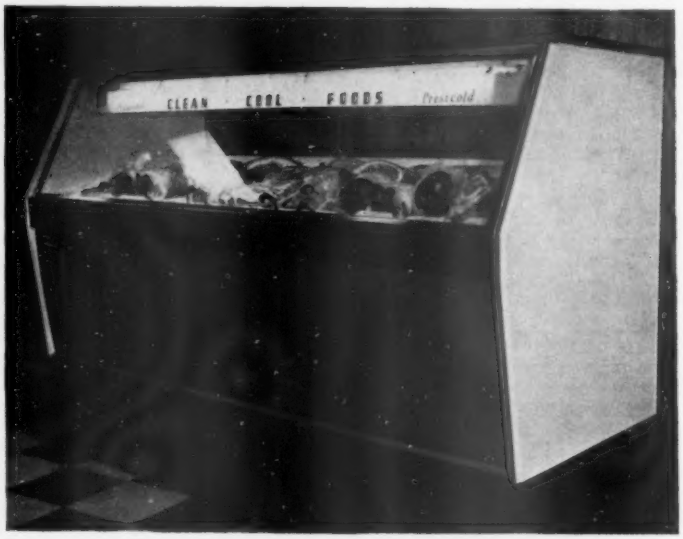

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REFRIGERATION FOLLIES —No. 5

"But lady when you ordered a fridge you didn't say nothin' about wantin' one what runs on paraffin!"

skin type condenser which uses the cabinet exterior surface for dissipation of condenser heat. Both Retailer and Vender are basically of the same design but the difference being as follows :—

The Retailer Major incorporates an attractive illuminated sales canopy. A large high grade angled mirror, set to reflect cabinet contents to customers' eye level, gives mass display. A dummy package display shelf is illuminated by a concealed fluorescent tube which also illuminates the quick-frozen food sign. Price is £159 10s.

In the Vender Major, attractive panels of high grade glass are arranged on the back and sides to cut off warm air cross currents. These panels lend themselves to the display of sales promoting slogans and material. This cabinet is particularly suitable for counter line or island site installation. Price is £152 10s. 0d. These larger, compact modern styled cabinets are full of new sales features, including : —Larger Capacity—To cope with the expanding market—12·3 c.ft. gross, (11·8 c.ft. nett), with a capacity over 400 lb. of packaged frozen food—nearly 800 packages : —Small Floor Space Size—51¾ in. by 28⅞ in., only 3 in. longer than the 9·6 c.ft. OFC 354, overall height —Retailer Major—56⅜ in., Vender Major—50 in.

SELF-SERVICE TRADE SHOW

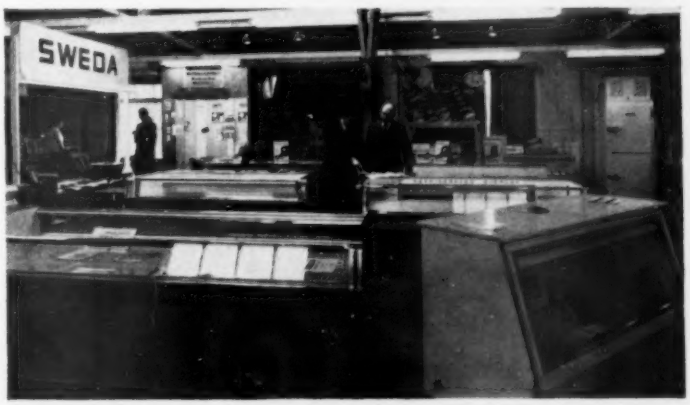
A SELF-SERVICE & Associated Trades Exhibition was organized recently by Messrs. Southern & Redfern Ltd., Yorkshire area distributors for Frigidaire, which was held at the T.A. Barracks Drill Hall, Bramley, Leeds.

The exhibition incorporated a model self-service shop designed by Wm. Mason & Son Ltd., Leeds. All the refrigeration equipment and fixtures were supplied by Southern & Redfern Ltd., and George Barker & Co. (Leeds) Ltd. Lighting was by Southern & Redfern Ltd., Bradford. There were also individual displays by the following firms who were co-operating with Southern & Redfern :—

Sweda Cash Registers (Northern) Ltd.
The Hartmann Fibre Co., Ltd.
Birds Eye Foods Ltd.
Country Stile Ltd., Ripon—a firm of poultry packers & distributors.

Self-service specialists were in attendance for consultation and advice on shop design, merchandizing, pre-packing, lighting and colour, refrigerated display and storage. The exhibition was most successful and well attended.

Birds Eye exhibited a full range of vegetables, fish, poultry, fruit and



special pre-cooked products, together with their latest pack of "dinner for one"—the complete meal of roast beef, chicken or hamburger steaks—a product now sweeping the market. All products were attractively displayed in the latest Frigidaire equipment, together with one of the largest selections in the United Kingdom of point of sale display material.

On the Hartmann Fibre stand there was an attractive and varied display of pre-packed fruit and vegetables supplied by Kenipax Ltd. of East Ardsley, Wakefield. An extensive range of pre-packed fresh meat and their new frozen visual meat pre-packs by Sto-Pak, Town Gate, Wyke was also featured and pre-packed eggs with eye catching point of sale material by Yorkshire Egg Producers Ltd., of Drighlington. Hartmann Fibre Co., displayed their new range of Green Foodtainer trays for produce pre-packing.

Sweda Cash Registers (Northern) Ltd. exhibited self-service check-out machines by Layback and Wm. Mason & Son Ltd. showed the Nordia range of self-service fixtures.

* * *

SEVERAL new Frostaire cabinets were shown at the Self-Service and Display Refrigeration Exhibition held last month by **Frostaire Refrigeration Co. Ltd.,** in their showrooms in Muswell Hill. Most striking was a four refrigerated deck cabinet made in 6 and 8 ft. lengths specially suitable for delicatessens and grocers. This cabinet is 5 ft. 6 in. high and 2 ft. 6 in. wide. It has four refrigerated shelves all illuminated with 5 ft. fluorescent tubes and a cabinet of steel on seasoned timber. The cabinet is operated by a ½ h.p. sealed unit with a five-year guarantee. Each shelf has a 2½ in. glass riser placed in front

Another new model shown was an 8 ft. long multi-deck display cabinet, all illuminated and operated by a ½ h.p. sealed unit with a five-year warranty. The cabinet has a 2 ft. 9 in. base ; the area on the bottom shelf is 20 sq. ft. on the second 16 sq. ft., and on the top 8 sq. ft. It is all steel made on seasoned timber. Two inches of polystyrene are used as insulation. The contrasting colours are blue trims against white facings. Fittings are of stainless steel with quarter plate glass housed on rubber chanelling. Each deck is illuminated by fluorescent tubes strategically placed behind the display signs. The price is £393.

A Canadian freezer the "McClary Easy" was prominently featured. This has a capacity of 13·24 c.ft. with outside dimensions of 63 in. by 29¾ in. by 29 in. Conveniently situated in the door are three separate racks which hold five 6-oz. cans each. In the freezer itself there are four specially designed shelves and a swing-out basket at the bottom. It has four shelf plates and four wall plates with built-in sub-zero freezing and a hermetically sealed ¾ h.p. compressor. In addition to this, Frostaire showed their normal range —including the "Super Six"—an illuminated three-quarter-vision counter, and a range of Swedish models.

* * *

Participation this year in the major European event the Hanover

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ROSS GROUP LIMITED

A YEAR OF GREAT ACTIVITY AND DEVELOPMENT

The following are salient features of the Accounts for the year ended 30th September, 1960, and the report by the Chairman, Mr. J. Carl Ross, to the Annual General Meeting on May 4th, 1961.

" Since my last report to you the policy of broadening the trading basis of the Group has been continued, the year being one of great activity. The Net Profit wholly applicable to your Company, after Taxation, shows an increase of approximately 80% at £494,213, a figure which does not reflect all the benefits of recent expansion, in that the profits of our new Subsidiaries have been included only from the date of acquisition."

After commenting on the continuing modernisation of the trawler fleet, the Chairman's statement continued :—

ROSS FROZEN FOODS

During the year under review, there was considerable expansion in both production and distribution of our Frozen Foods, sales having increased by 54% on those of the previous year. To meet ever-increasing demand for our products, your Board has allocated a further £1 million for immediate extensions to our production factories, plant and distribution centres. The closest co-operation exists between your Company and its Associates, Chr. Salvesen & Co., Ltd., (owners of Britain's three Factory Trawlers " Fairtry " I, II, III) on the production and sale of Fish Frozen at Sea. The preparation, from this source, of fish sticks for the housewife and fish portions for the catering trade, enables the Company to maintain a constant supply of top quality fish to the consumer. Steady progress has been made in Export Sales and in the creation of an efficient organisation capable of taking full advantage of anticipated future expansion.
Constant research aims at increasing the range of products available, and most careful control ensures that only the very best is good enough to be packed under the " ROSS " label.

THE YOUNG GROUP OF COMPANIES

It is gratifying to report that this Group has experienced successful trading and again made a substantial contribution to our Profit, Sales of quick-frozen Shellfish products have continued to rise throughout the past year, a tribute to the excellence of these specialities. To ensure absolute freshness of product, freezing and packaging must be carried out at our many stations situated on the coast. During the year, extensions to premises and freezing installations have been made, which will provide additional supplies of Lobsters, Crabs and Prawns to meet assured demand for these ready-prepared delicacies.

OTHER ACTIVITIES

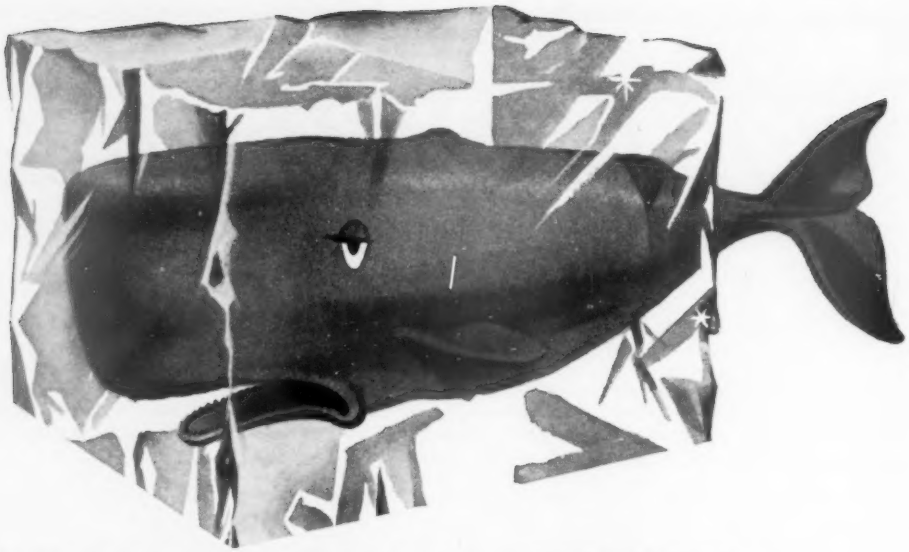
A comparison of the turnover for 1960 with that of five years ago gives a clear indication of the rapid advance and diversification in the trading pattern of your Group :—

	1955	1960
	£	£
Value of fish landed from our vessels	2,000,000	4,000,000
Fish Trading at the Ports, Inland Wholesale & Retail	5,000,000	9,500,000
Shipbuilding, Engineering, Motor Transport & Motor Distribution	200,000	3,500,000
Frozen and other Foods Production & Distribution	300,000	11,000,000
	7,500,000	28,000,000

Whilst this table shows the remarkable increase in the sales of our Frozen Foods and other Foods it should not be overlooked that your Group is, at the same time, the largest distributor of Fresh Fish in the country, a nationwide network of depots ensuring a first class service to all fishmongers and fish friers. 80% of all fish sales in the United Kingdom are of Fresh Fish.

The expansion in your Group's interests has continued since 30th September, 1960, by further acquisitions, resulting in the issue of 305,872 Ordinary Shares of 5s. each. These acquisitions will strengthen our activities mainly in the Frozen Food and other Food sections of the Group.
The Meeting confirmed the payment of a total dividend of 20% (less tax) and sanctioned the creation of a further 4,000,000 Ordinary Shares of 5s. each. If the recent offer for the acquisition of Sterling Poultry Products Limited is successful, 2,764,685 Ordinary Shares will remain unissued.

Copies of the Annual Report and Review are available from the Secretary,
1, HUTTON ROAD, GRIMSBY



WILLIAMS FASTER FREEZING

makes a whale of a difference

Williams Plate Freezers *are* being used for whale meat, but, nearer home, these double-quick freezers are making a whale of difference to shrimps, fish, peas, fruit and every other kind of frozen food, too. The smaller ice crystals produced by the faster freezing of Williams Direct Conduction Plate Freezers means better flavour, retention of nutrient value and greater production capacity—that's money, commercially speaking. Write for fuller details and find out which type of Williams Double Contact Alloy Plate Freezer, with hourly capacities from 200 to 5000 lbs., could best be tailored to your organisation.

One of four Williams Contact Freezers supplied in 1958 for A/S Tonsberg Hvalfangeri, to operate in the Antarctic. Each freezer takes a load of over 2 tons of whale meat in 85-lb. blocks 4 ins. thick. Total capacity of the four freezers —2¾ tons per hour. The recently introduced "Direct Conduction" plates applied to a similar sized installation would increase the capacity to 5 tons per hour.

WILLIAMS of LONDON

in association with **GRASSO** of Holland

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Fair was new to both **Williams** and **Grasso.** A complete range of Grasso compressors, a Williams plate freezer and Grasso extended surface air cooling units were shown and attracted a great deal of interest. Many Continental and Scandinavian companies had heard of the advantages offered by Williams " direct conduction " freezing plates but, until this show, few had been able to inspect them or discuss their performance. It is sufficient to say that all the engineers and processors who inspected the freezer appreciated the potentialities of this now well established development. Grasso were very enterprising and ambitious in the installation of a complete automatic ice-making plant on a site adjacent to the hall in which the refrigeration exhibits were located. The plant had a capacity of 10 tons of block ice per day, alternatively 17 tons of crushed ice and throughout the fair the machine produced these quantities on alternate days. The crushed ice manufacture included drying, sub-cooling and bunkering arrangements, adequate proof that this method is firmly established. Williams staff left the Hanover Fair and returned to London to prepare for the British Trades Fair in Moscow held from May 19 to June 4. Williams exhibited freezing plant at this important event.

E. ANGLIAN MEETING

(continued from p. 576)

Ships would have to be different from those we have now. Having to go further afield (three weeks' voyage each way possibly), would involve landings from a ship carrying 500 tons at a home port. It would be much better to transfer it to a carrying vessel and bring it home by a large cargo vessel in bulk.

There was the question of the reaction of the crews and we would probably find that not all would be recruited from our own fishing ports. But traditional fishing must go on. One would have to learn to use other varieties. So what we caught and where we landed it would probably alter in the next 10 years.

Mr. Brown of Refrigeration East Anglia asked whether the aircraft industry had participated in this at all, with the possibility of aircraft pick-up ?

Commander Ranken replied that he had heard it spoken about. The Greeks land in Morocco and carry some fish back to Greece where prices are better and there is a market for whole frozen fish. He said that he felt, personally, with the bulk that we had been talking about it would take time and probably would not be a cheap way of doing it. If the fish were frozen it could, of course, be stored longer where it was landed. Aircraft could be used mainly for fresh fish and if it would carry enough to make it economical then it might come. There might be the added problem of getting the fish to the aircraft, as airfields are generally not adjacent to the fishing grounds.

He said that Saunders Roe were doing a lot of research work in their tanks, on the subject of fishing gear.

Mr. V. S. Meadows, chairman of the association, thanked Commander Ranken warmly for coming down to Norwich to give this very fine lecture and wished him every success on his pending visit to Moscow.

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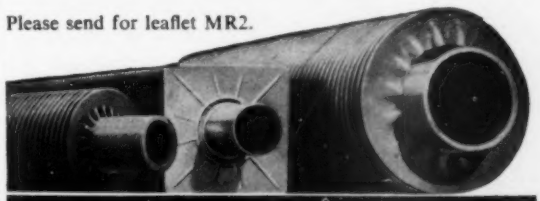

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Separation of Gases of Dissociated Ammonia by Electric Furnace Process

By A. HEGARTY

A NEW process using anhydrous ammonia as the hydrogen source is a result of the combined research efforts of Armour Industrial Chemical Company, The Dow Chemical Company, and The Electric Furnace Company who have built a 750 Scfh plant. The companies concerned believe that such a source of H_2 will be attractive to industries requiring intermediate quantities of H_2 of higher purity than dissociated ammonia but not necessarily as pure as commercial cylinder H_2. The standard 750 Scfh package adsorption plant is shown opposite.

Two-Stage Process Used in New System

The *first* stage dissociates commercial or refrigerant grade anhydrous ammonia into H_2 and N_2 using a conventional ammonia dissociator. Either liquid or gaseous ammonia may be used.

Anhydrous ammonia is fed from storage cylinders or tank to the dissociator unit. The feed stream is preheated in a heat exchanger which is included as part of the dissociator unit, and cracked to hydrogen and nitrogen at high temperature, in the presence of a suitable catalyst. A control system automatically maintains the proper pressure and temperature in the dissociating furnace. Dissociated ammonia is delivered to the adsorber system at 1 to 5 psig and cooled to 30° C. The composition is 75 per cent. H_2 and 25 per cent. N_2 and normally with 50 to 100 parts per million of residual (undissociated) ammonia.

The *second* stage purifies the hydrogen in the hydrogen-nitrogen mixture by removal of nitrogen in the adsorption units. Three adsorption units are used in the system to provide continuous delivery of purified product gas. The dissociated ammonia or hydrogen-nitrogen mixture enters a feed gas compressor where the mixture is elevated to approximately 110 psig then cooled in an aftercooler. The compressed gas is then admitted to one of the three adsorbers for a period of approximately 80 seconds, elevating the pressure from 10 MM Hg. absolute to about 100 psig. The adsorption towers or adsorbers consist of cylindrical steel chambers filled with activated charcoal. As the gas passes into the charcoal bed of the adsorber, the nitrogen is adsorbed by the carbon particles. Any residual or undissociated ammonia is also adsorbed by the charcoal bed. As soon as the 80 sec. pressurizing step is completed, the inlet control valve closes and the outlet valve to the product gas compressor and receiver opens.

The hydrogen (not adsorbed by the charcoal) is released through this outlet and the unit is depressurized in 80 sec. or less to a predetermined pressure. Electrical contacts of a pressure switch close this valve at the predetermined pressure. It is very important that the adsorbers depressurize to a predetermined pressure on each occasion or the product purity and yield will both be affected.

The gas that first passes from the adsorber is high in hydrogen (about 99.8 per cent.). As the pressure falls the nitrogen content of the flowing gas becomes higher until the cut-off point is reached. The composite of all the gas delivered in the 80 sec. period has the composition desired and determined by the cut-off pressure. As soon as the product gas delivery valve closes, the evacuation line opens, allowing the vacuum pump to lower the pressure in the adsorber bed to a final pressure of 10 mm. This step, again for 80 sec., draws the residual hydrogen, adsorbed nitrogen and residual ammonia from the charcoal bed, discharging it to the atmosphere through a vent stack. This evacuating cycle reactivates the charcoal bed and thus it is prepared to receive the next charge of feed gas.

The product gas released from the adsorber after proper pressure regulation is pumped through the product gas compressor and discharged under pressure to the receiver. This compressor has capacity to take the gas at the maximum rate of expansion from the adsorber and recirculate it through the receiver tank to mix the product gas to a uniform purity of 95 per cent. or better. The product gas can be drawn from the receiver through a pressure reducing regulator as needed by the consumer. Receiver tank pressure will vary according to rate of consumption of the product gas. If the rate of use is reduced drastically then receiver tank pressure builds up to a predetermined pressure and by-passes back to inlet of dissociated ammonia compressor.

The first gas that passes from the adsorption units is about 99.8 per cent. hydrogen. As the pressure falls when the outlet valve opens, the flowing gas from the adsorber becomes higher in nitrogen content. However, 99.4 per cent. purity hydrogen can be produced with approximately 41 per cent. recovery of the hydrogen in the dissociated ammonia. It is possible to obtain a high purity product with this system but at proportionately higher cost and lower production. At the design cut-off pressure point for

delivery of approximately 96 per cent. hydrogen gas from the system, the composition of the final gas from the adsorber tower just prior to cut-off is approximately 79 per cent. hydrogen and 21 per cent. nitrogen. Design capacity is based on an 80 sec. cycle. However, the composite of all of the gas delivered in the 80 sec. cycle has the composition of 96.3 per cent. hydrogen and 3.7 per cent. nitrogen.

Adjustment of the adsorption cycle timing and pressure at which the outlet valve from the adsorber closes, provides a means of adjusting the system to produce hydrogen (composite product) purities higher than 95 per cent.

Regulation of Purity and Capacity

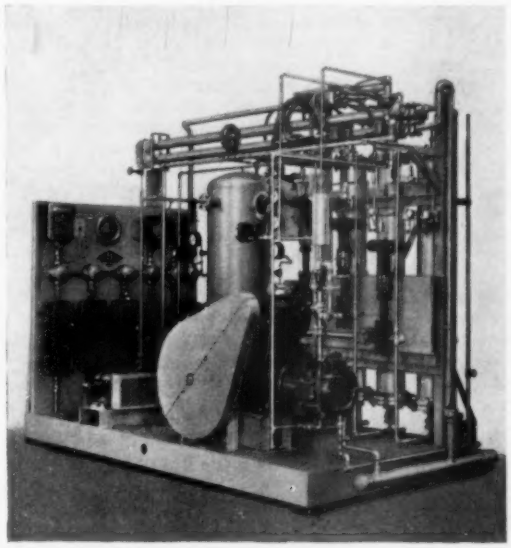
The output of the system can be altered by regulating the timer for a longer or shorter than 80 sec. cycle. To decrease the production rate, it is necessary only to reduce the number of cycles completed per hour by adjusting the timer control for cycles of longer duration. The capacity can be increased by adjusting the timer control for cycles of shorter duration, but there is a limit here, governed by the maximum capacities of dissociator, compressors and vacuum pump. Since the feed gas compressor has a pressure controlled by-pass valve, reduction of compressor speed is not necessary when lowering the output of the system. When the adsorber output is decreased or product gas use is reduced, the volume of feed gas to the main compressor will change correspondingly. This means that the dissociator furnace and the initial ammonia feed must be reduced automatically, a feature which is accomplished by the control and safety equipment on the dissociator unit.

The product gas purity is changed by adjusting the delivery cut-off pressure on the depressurizing cycle. By increasing this cut-off pressure, hydrogen of greater purity can be produced with corresponding reduction in yield. In the same manner lower purity hydrogen with increased yield can be produced. In the case of reduced consumption with no adjustments made to the system, recycled gas from the product receiver will be subjected to another adsorbing cycle and the product purity will go up.

If the dissociator is on standby, the system can be in operation in half an hour. If the dissociator is cold, start-up to full production required only about five hours. The ability to vary the output volume of the system is an unusual feature, because it is accomplished without loss of product quality. It is practicable to vary output from full capacity to as little as 25 per cent. capacity during periods when product demand is low.

Three adsorption units are used in the Electric Furnace Company system. These units are automatically cycled to provide continuous flow of product gas to the receiver. While the No. 1 adsorption unit is receiving its charge of hydrogen-nitrogen mixture, the No. 2 unit is delivering finished product gas to the product gas compressor and receiver and unit No. 3 is being purged of nitrogen by the evacuation system. By cycling in this manner, every 240 seconds—80 seconds pressurizing, 80 seconds depressurizing, and 80 seconds regenerating —product flow is maintained constant. There is no possibility of CO or CO_2 contamination of the purified hydrogen, as is the case with some other processes using a different basic gas.

A product gas analyser detects any infiltration of oxygen to the system by continuously analysing a sample of the product gas and indicating in percent. of the lower explosive limit of oxygen in hydrogen.



An alarm is actuated when the oxygen content exceeds 0.2 or 20 per cent. of this limit and the system is shut off.

A low pressure cut-off switch at the feed gas entry to the system senses any drop in pressure and shuts down the system. Gas is by-passed from the high pressure side of the compressor to maintain a pressure of at least 1 psig. at the feed gas entry to the compressor. This prevents excessive flow of dissociated ammonia from the dissociator at the instant when an evacuated adsorption unit is opened to receive its charge for pressurization.

Another cut-off switch senses failure of the vacuum pump. A temperature switch shuts down the system if there is an interruption of cooling water. The product gas receiver is protected against over pressure by a relief valve. Each of these protective devices will shut down the system and close all control valves. Explosion-proof wiring is used throughout the purification system.

Because simplicity generally results in lower cost and more compact designs, this was a major objective both in research and pilot plant design. The result, for example, in a 2,000 Scfh plant excluding ammonia dissociator and ammonia storage facilities, is a skid-mounted package approximately 7 ft. wide by 18 ft. long by 10 ft. high completely factory assembled, piped and wired, with all process controls included ready for operation as soon as utilities are connected.

REFRIGERATOR FINISHES*

By R. A. FIDLER
Robt. Ingham Clark & Company

OF the various groups of paint available, the synthetic resins are the materials used in the formulation of paints for the refrigerator industry. The term synthetic has often been misapplied and presents in the minds of people the idea of substitute. Synthetic is derived from the word " synthesis " meaning a building up or putting together and when applied to resins is based on the fact that such resinous materials possessing as they do complicated structures, are formed or built up from non resinous materials of relatively simple structure. The synthetic resins are therefore produced initially in a pilot plant on a laboratory scale and then in bulk in the works.

In this group are the alkyds, the melamines, the phenolics, the acrylics, the vinyls, the epoxies and many others, all with their own particular advantages and disadvantages, so that there are many permutations possible in paint manufacture to ensure that the right material is selected.

Methods of Application

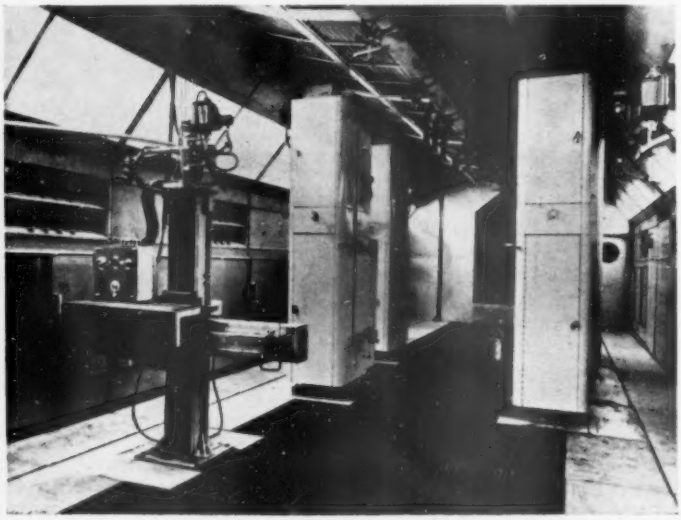
The hand spray gun, where compressed air is used to atomise the paint, is an extremely versatile method of application permitting the spraying of articles of intricate shape and also rapid change from one colour to another. On the other hand the efficiency of the method can be low due to paint wastage by overspray. In practice, therefore, the amount of dried paint actually deposited on a particular surface can be much less than the theoretical mileage. When planning a painting process it is desirable at an early stage to discuss the method of application with the equipment manufacturers and paint suppliers to ensure that the most suitable paint is utilized with the most efficient method of application.

Processes

Adequate cleaning of the surface is essential and rust, grease, graphite and other contaminants should be removed by solvent wiping, flame cleaning, pickling, shot blasting, vapour degreasing or other cleaning solutions. Some form of pre-treatment such as phosphating is then to be recommended and when products are painted on a production line it is often an easy matter to pass them through a series of tanks containing the various cleaning and pretreatment solutions. As part of this process phosphating imparts a chemical film to a metallic surface assisting the adhesion of the paint and also increasing the corrosion resistance.

The domestic refrigerator manufactured on a production line basis is constructed usually from mild steel or zinc coated steel. If the phosphating process is employed the refrigerator cabinets then pass through tanks containing an aqueous cleaner, usually alkaline at 200° F., a cold water rinse, the phosphating solution, another cold water rinse, then a hot water rinse and finally a chromic acid rinse containing 4 oz. chromic acid/100 gal. water.

After drying the cabinets in an oven a coat of primer is applied by dipping, flow coating or spraying by hand, automatic Schweitzer, or electrostatic processes, to obtain a dry film thickness of 0·75 to 1·0 mils and then stoved for 20 to 30 minutes at 350° F. The primer is usually based on epoxy resins and must adhere satisfactorily to the metal, fill the pores and provide a good key for the enamel ; it must possess good alkali and water resistance and be tough yet flexible. The enamel coat is then applied by spraying by hand, automatic Schweitzer or electrostatic methods, to achieve a dry film thickness of 0·75 to 1·0 mils., and then stoved for 20 to 30 minutes at 280° F. The enamel, usually a mixture of alkyd and melamine resins must of course be white and glossy and

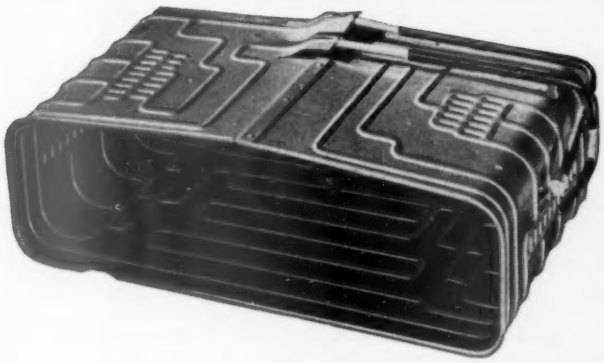


Schweitzer automatic spraying plant for painting refrigerators (Carrier Engineering Co. Ltd.)

* Extracts from paper presented at Convention held in conjunction with International Refrigeration Exhibition at Earls Court, as also is the case with the paper overleaf.

Marston Evaporator Units

Light alloy roll-welded evaporator units offer many advantages: superior performance, light weight, attractive appearance, flexibility of design, competitive prices. A production line specially equipped for the fabrication of these units is operated by Marstons, specialists in heat transfer for sixty years. Why not discuss your design and production problems with them?



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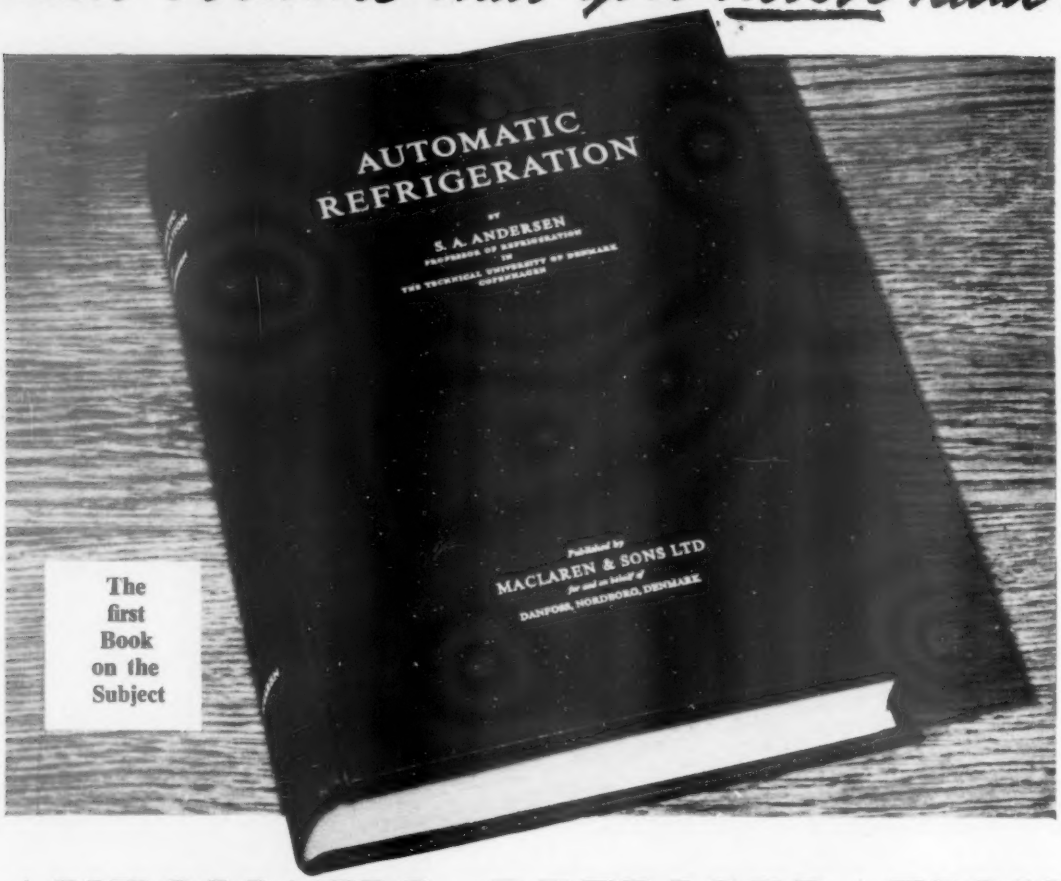

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not discolour during stoving or on exposure. It must again be hard yet flexible and withstand moisture also foodstuffs, even lipstick and bootpolish which may come into contact with it. Most important, it must not affect foodstuff in any way and impart to it an unpleasant taste or odour.

The Future

The increasing use of strip coating or prepainted metal could be the answer as the strip is cleaned and painted in the most efficient way. By this method steel or aluminium in strip form is cleaned, pretreated, painted, stoved and recoiled at a speed of 60 ft. per minute. The strip is pulled by a drive unit at the recoiling end and thus is its own conveyor taking it through the various stages. After passing through each cleaning and pre-treatment tank rubber rollers squeegee off excess solutions and the strip is dried through a heated section. Paint is applied to one or both sides of the strip by passing it over a series of applicator rollers and the strip is then stoved. Up to this operation the strip has passed over supporting rollers but these cannot be used whilst the paint is still wet and the strip is unsupported during its passage through the oven, a length of about 60 ft.

Already pre-painted strip is being used for a variety of jobs and fabrication into simple shapes is possible. The roller coat application not only ensures maximum efficiency, almost 100 per cent. but accurate control of the film thickness is possible. Pre-painted strip is available in the U.S.A., up to 48 inches in width and this would enable the fabrication of complete cabinets. Work has also been carried out on bonding two sheets of metal to expanded polystyrene so that the interior and exterior surfaces plus insulating section are available in a simple form. Dispersion coatings applied by roller coatings can be embossed after stoving so that range of decorative finishes are available suitable for trim and mouldings, etc. There are of course many problems which have to be overcome, particularly in making suitable joins as spot welding or brazing would ruin the paint film. These problems should not be insurmountable and the prizes are sufficient to make the effort worthwhile.

Aeronautical Cooling

By D. J. LEECH, B.Sc., A.F.R.Ae.S.

Project and Performance Engineer, Normalair Ltd.

ORTHODOX vapour cycle refrigeration is being increasingly used on large civil aeroplanes and does have some military applications. With the present generation of subsonic civil airliners, vapour cycle refrigeration has sometimes been demanded by operators, particularly in North America, as the best method of cooling in hot humid ambients before the engines are run at full r.p.m. or even before the engines are started.

The vapour cycle system is particularly suitable for driving electrically, or from any source outside the aeroplane, because of its low power consumption.

Most of the virtues of vapour cycle cooling, however, stem from the failings of air cycle systems. Because of the comparatively low power consumption and because it lends itself to cooling by recirculation, a vapour cycle system enables us to pump in as much refrigeration as we wish without increasing fresh air flow.

The system is packaged so as to fit into the leading edge of the wing root and to have a self-contained " Freon " circuit. That the " Freon " circuit be self-contained is very important where quick servicing is necessary, for pack replacement is then possible without breaking " Freon " lines and therefore without recharging. The compressor is a two-stage centrifugal, turning at 24,000 r.p.m. and driven directly by a 400-cycle A.C. motor. The evaporator will give a nominal 10 tons of cooling and the whole package weighs a little over 200 lb. The system can be run when the engines are not running provided that a source of 400 cycle electrics can be made available. A problem is that the electricity has to be from a frequency stable source since the compressor is very sensitive to speed variation.

The use of a 400 cycle source of power enables much lighter weights to be achieved than does the use of the 28 volt D.C. power. A.D.C. powered system has been designed but since high speeds are not readily available a reciprocating compressor was used and the weight of a 6-ton (R) compressor and drive was three times the weight of the 10-ton compressor and drive.

Air turbine drives are sometimes used to supply the power for vapour cycle systems. Turbine drives are very light and also permit the very high speeds which give small compressors. A turbine powered " Freon " system has been produced which weighs less and produces 30 per cent. more cooling.

The " Freon " system incorporates a compressor, which is the heart of the system, driven by an air turbine at speeds up to over 50,000 r.p.m. and this high speed enables the high pressure ratio necessary to be produced in a single stage centrifugal compressor. Condensing is at 160° F. and evaporating can be as low as 50° F. so that the pressure ratio is higher than we would normally expect from a single-stage compressor. Apart from a little stretching the wheel was designed using the same technique as for the design of an air compressor and the " Freon " was treated as if it were air, in that the normally accepted values of the Mach numbers for air were applied for " Freon " gas. The only complication is that with " Freon " gas, in the neighbourhood of the saturation line, the departure from the Gas Laws is appreciable and the physical relationship has to be taken from a chart or table.

For the common " Freons," sonic velocity is very much less than for air (about a third) so that tip speeds are low and hence " Freon " compressors are, in general, lowly stressed. In this case, " Freon 114 " was used as we are normally able to get more orthodox wheel shapes with the lighter " Freon " but an American company have made a much smaller unit to compress " Freon-12." This small unit turns at well over 80,000 r.p.m. and it is said to provide 10 tons of cooling.

The temperature control is carried out by raising or lowering the evaporating temperature which, in turn, is achieved by reducing or increasing the turbine airflow. This method of temperature control permits much greater reduction in power at low load than in the systems with fixed speed compressors. This power saving is, however, partly offset by the fact that the nozzle of the turbine is chosen to be very large so that sufficient power is available to run the compressor at low engine r.p.m. (low air supply pressure) and the full advantage of high pressures from the engine, is not available. The condenser and evaporator are of similar construction to the heat exchangers already described, although there is a shortage of accurate data on the heat transfer of condensing " Freon " and there was some guesswork involved in designing the condenser to very severe space and weight restrictions.

Engineering, Marine, Welding and Nuclear Energy Exhibition

The **British Rototherm Co. Ltd.**, exhibited a comprehensive range of dial thermometers, recorders and controllers under the following main headings :—

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Distant reading and rigid stem models : 4 in., 6 in., 8 in. and 10 in. dials, wall, panel or bracket mounting, in modern styled cases with bulbs and capillaries to suit requirement. Edgewise scale distant reading patterns, max./min. and control/alarm thermometers. A number of patterns for special applications will be included.

Vapour Pressure Thermometers

A wide range of distant reading and rigid stem vapour pressure thermometers in 2½ in. to 8 in. dial sizes. Special purpose, max./min. and control/alarm models will be included.

Mercury-in-Steel Temperature Recorders.

Single and dual pen recorders. Wall or panel mounting, in modern styled cases. Anti-vibration mountings available. Wet and dry bulb recorders. Portable recorders.

Temperature Controllers

Two recently introduced models were shown in addition to an interesting range of compact and reliable on/off controllers. These are available as indicating and non-indicating models with fixed or variable differentials and also as bi-metal, mercury-in-steel or vapour pressure thermometers with electric contacts.

Pressure Recorders

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Fully descriptive literature on instrument panels was also available on the stand.

CAPE INSULATION

The first model of the molecular structure of asbestos ever to be made in this country was displayed on the stand of **Cape Insulation and Asbestos Products Ltd.**, newly formed subsidiary of The Cape Asbestos Co. Ltd.

Amosite asbestos from the Cape group's own mines in South Africa is the basis of the "Caposite" moulded thermal insulation blocks and pipe sections which are the principal exhibits on the stand, together with CIAP's other insulation products "Rocksil" rock wool, "Caposil 1400" calcium silicate and "Caposil HT"—a range of materials fit to provide "all the answers" in the lagging field. Also on the stand were examples of "Marinite" non-combustible sheet manufactured by Marinite Ltd., another Cape subsidiary.

METAL FINISHING DIVISION

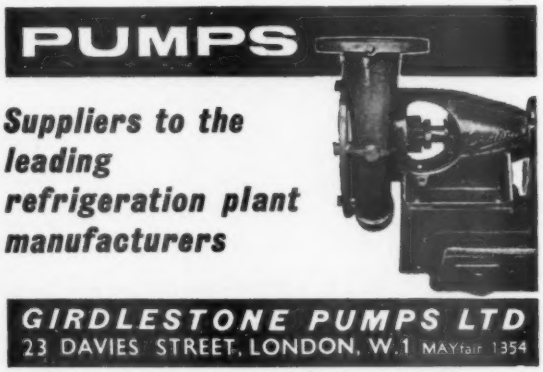
The theme of the **Metal Finishing Division Stand** this year showed how their "bonderizing" and "Parkerizing" phosphating processes help industry at the initial manufacturing stages of steel parts and in their final finishing treatments.

Part of the exhibit was devoted to the use of bonderizing in the cold forming field, *i.e.* for assisting wire drawing and tube drawing and the use of bonderizing/bonderlube for aiding the deep drawing and cold extrusion of steel. Photographs of typical plants and examples of formed parts were displayed.

The other section of the stand was devoted to the use of pyrene phosphate processes for finishing components and shown here were : bonderizing as a base for paint, parkerizing as a rustproofing finish and "parco-lubrizing" for wear resistance.

An incidental display showed the use of pyrene bonderite chromating processes for increasing the bare corrosion resistance of galvanized parts with particular reference to the prevention of "white rust." This was demonstrated by showing untreated and treated galvanized tubes.

Also displayed were the new "parker" finishes P45B and P45C. These are quick air drying materials for use after bonderizing or parkerizing, giving maximum adhesion and corrosion resistance.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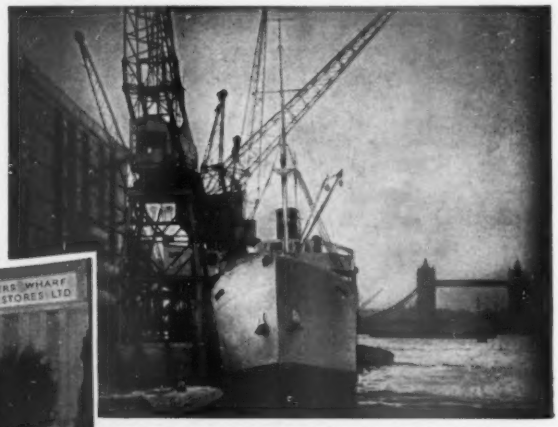

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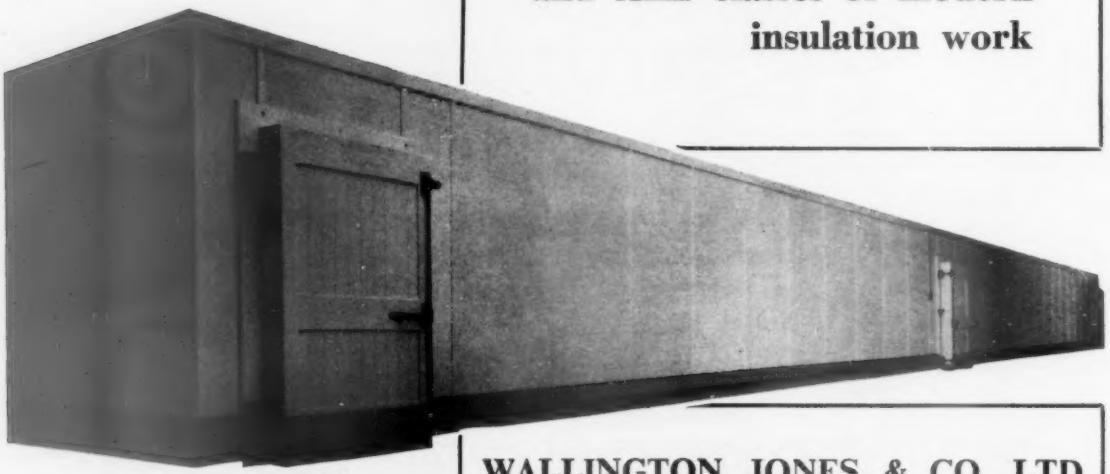

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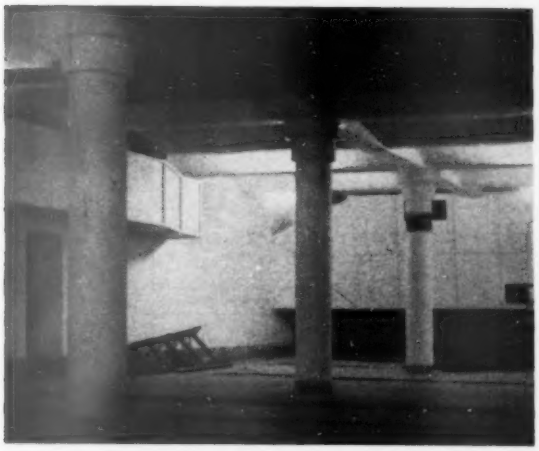

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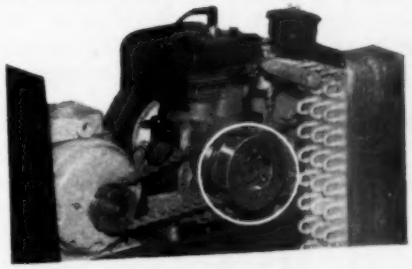

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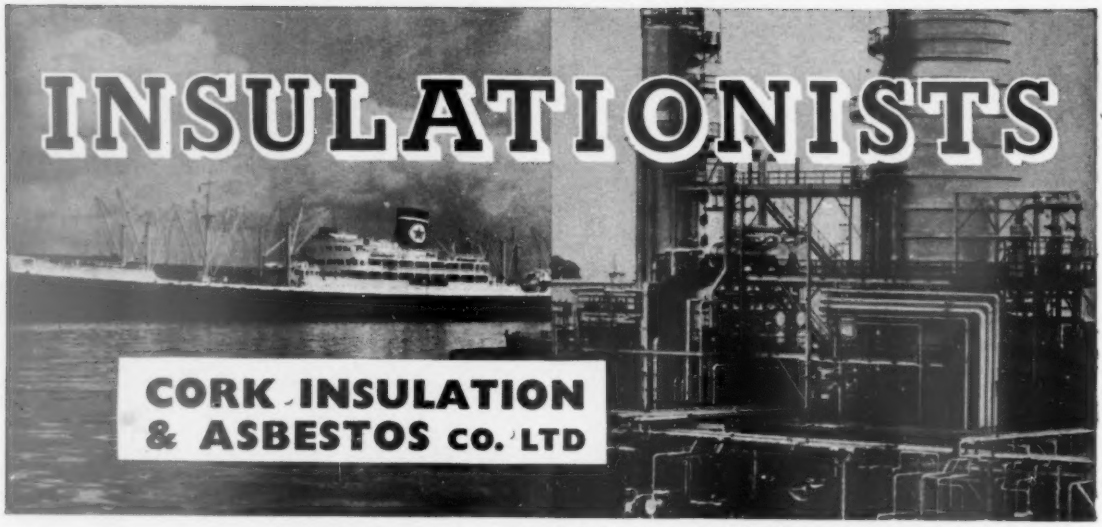

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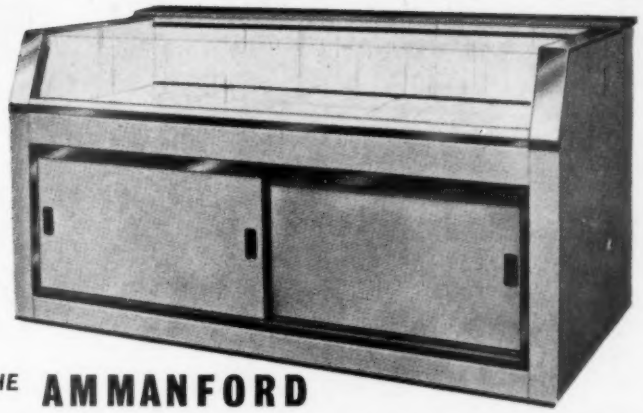

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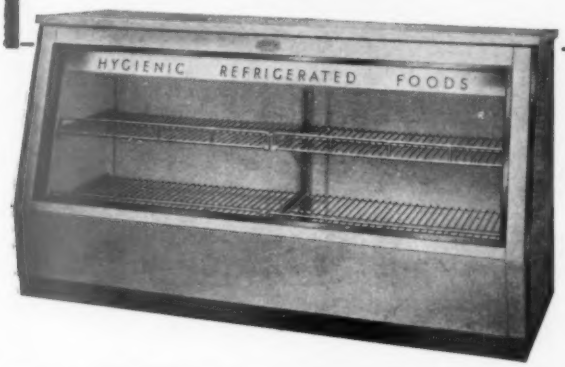

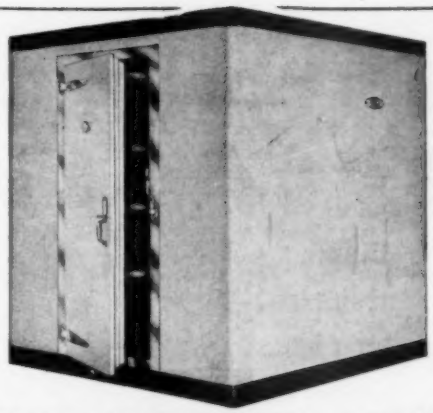

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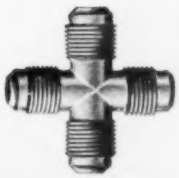

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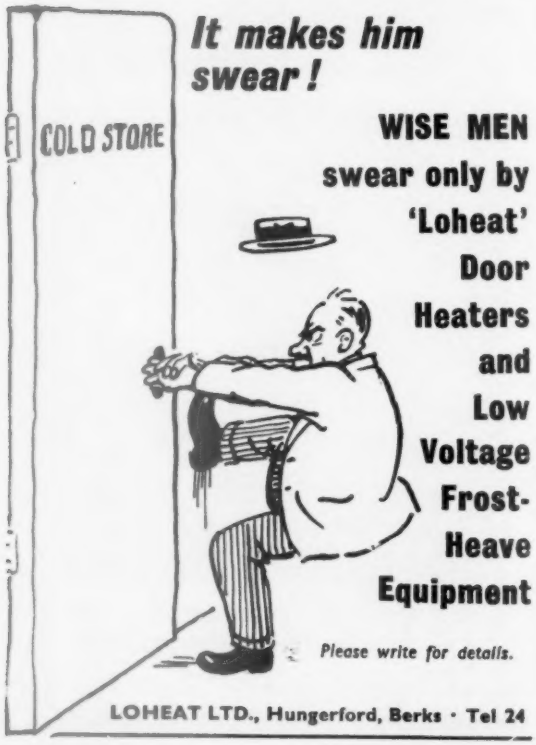

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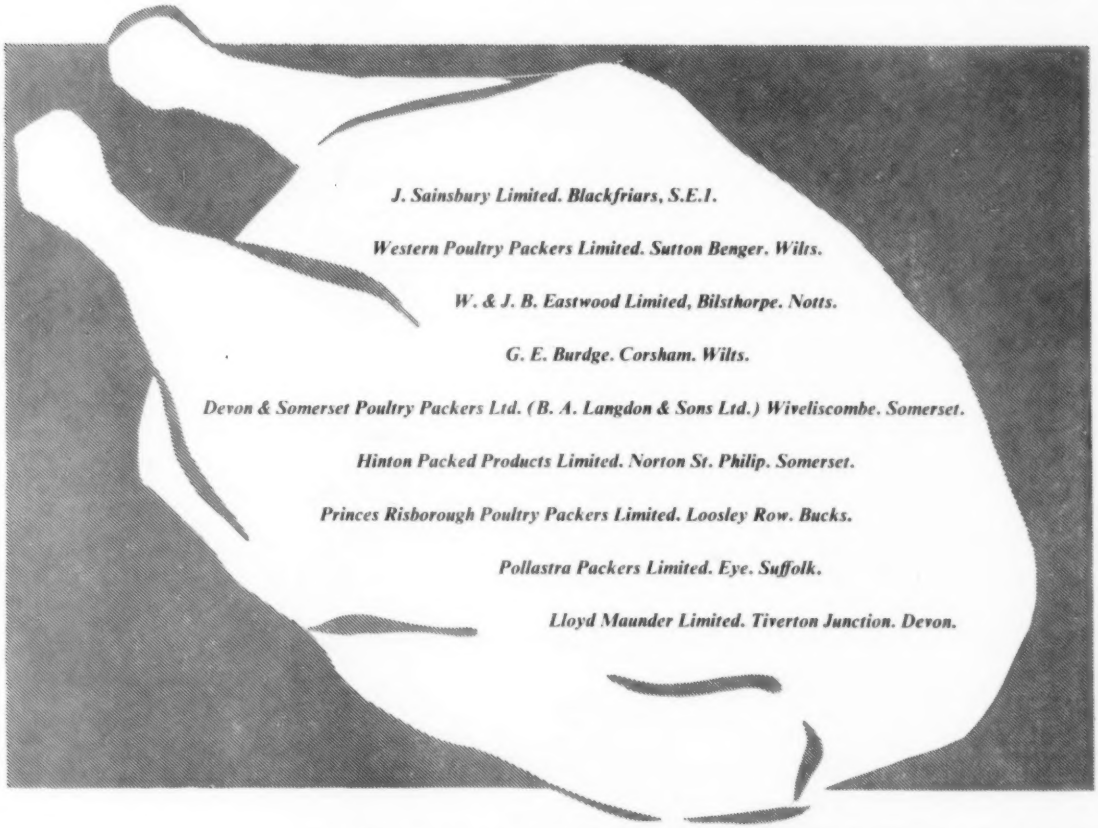
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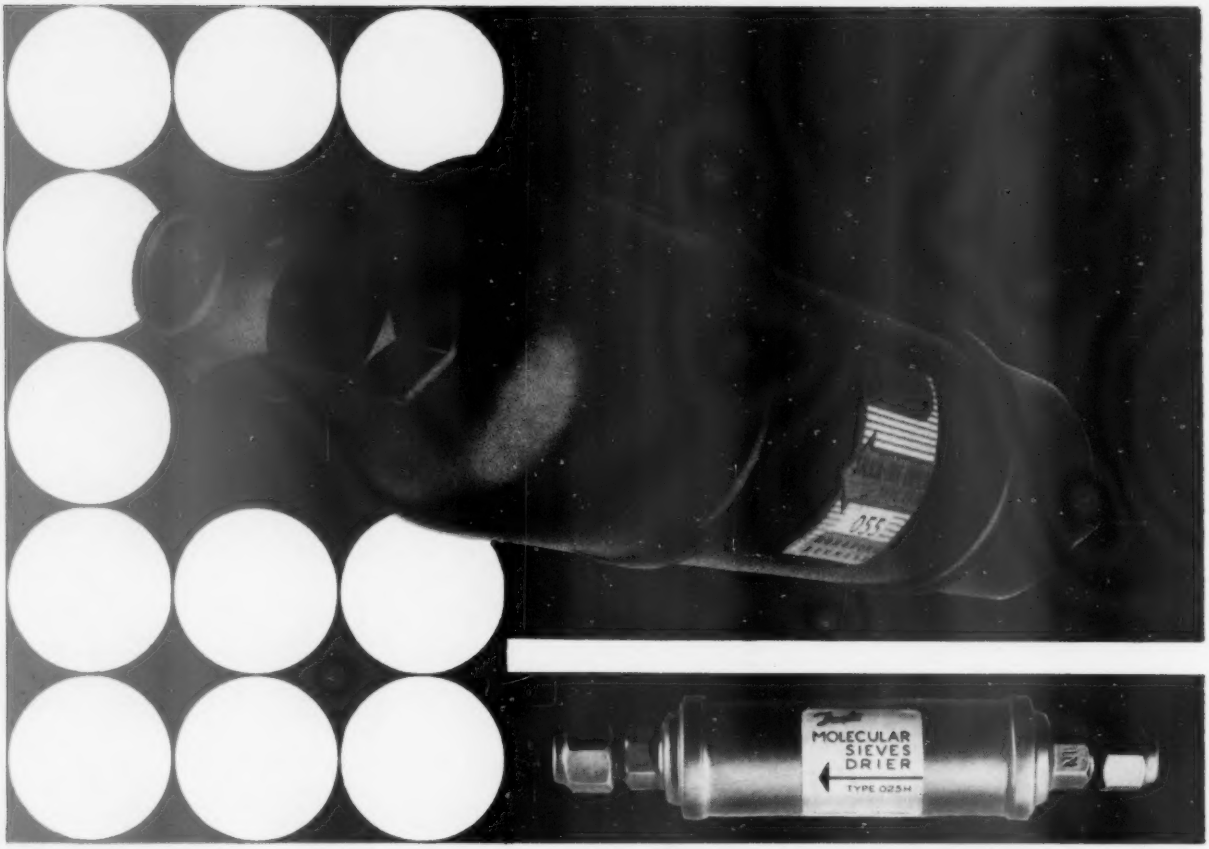

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